ELECTRICAL TIMES

THURSDAY
19 OCT.
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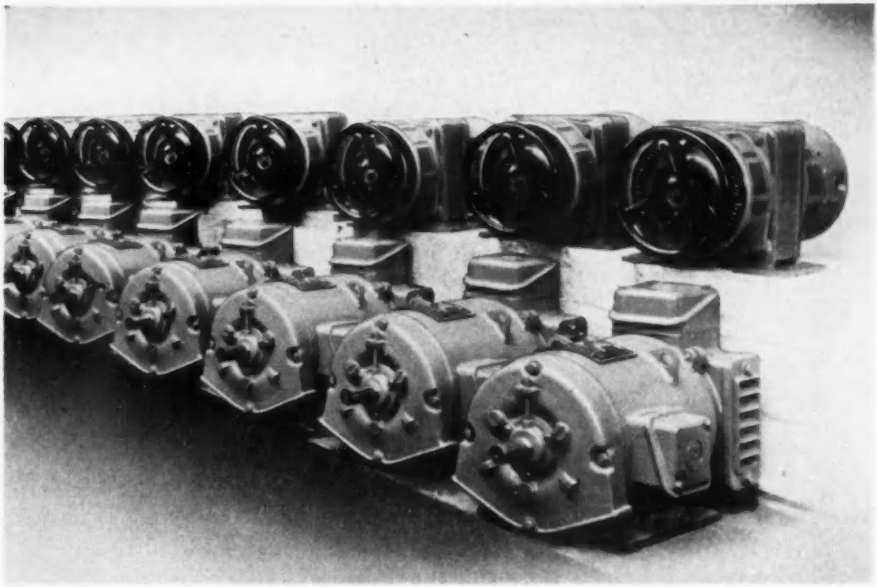

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It isn't only on the bigger jobs that the "N-S" variable speed a.c. motor proves its worth. In many instances, stepless speed control is just as important for machines needing under ten horsepower.

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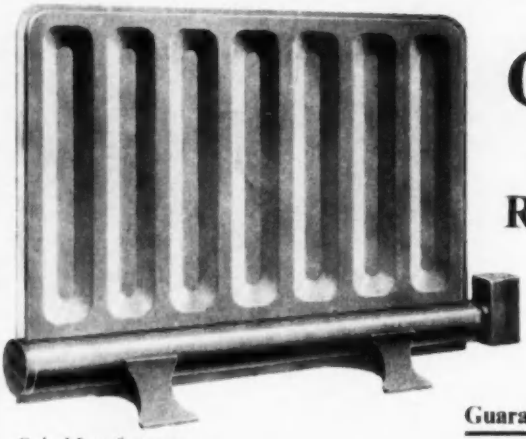

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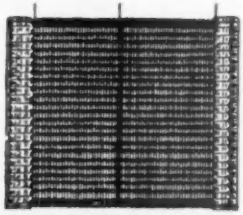

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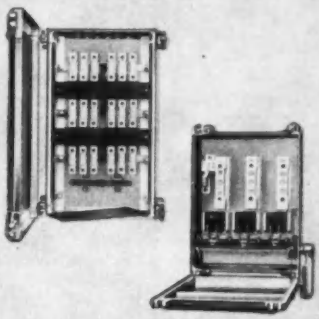

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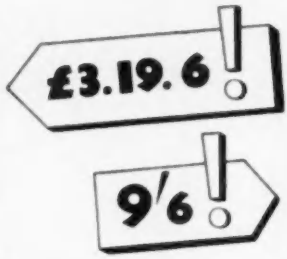
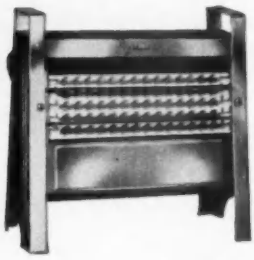




1912–1950

The Story of BELLING *& Company Ltd.* No. 15

In this chapter we come to 1935, which also was rather a red-letter year.

We improved our Baby Cooker, List No. 40, and were able to price it at £3 19s. 6d. This was a marvellous seller and we had the market for many years and did first-class business with it. This was the cheapest figure we ever got our Baby Cooker down to.

On looking through our catalogue, I see that our 1-kW Dinkie Fire was listed at 9s. 6d., which was also a marvellous seller and the cheapest 1-kW fire we ever produced. Mr. Wishart, our General Manager, joined us also in this year and, of course, is still with us.

Around about this time I did quite a lot of travelling, going to the U.S.A., Canada, South Africa, Egypt and many countries in Europe. We opened up a much larger business with South Africa and issued a special catalogue for that country.

One other rather important happening in this year, 1935, was that I converted myself into a private limited company as I had got a bit sick of paying super tax on works extensions, etc. Of course I ought to have done this years before, but I was always an individualist and was prepared to pay for the honour—until it got too heavy.

This brings us to 1936, and on looking through our catalogue for that year I find we introduced several illuminated fires (of course, our first original Standard Fire was illuminated also). Other fires contained a combination of radiant and convected heat.

Looking at cookers, I see that our frameless glass door was started in this year, which is exactly what we are using now and was the subject of my patent for this particular time. Also in connection with cookers I see we started our "Temset" system of oven control, which consisted of a constant loading with a booster load going on and off as required. This, of course, is the right theory for oven control and is really in practice far better than the system where the whole of the oven loading is switched on and off by the control switch.

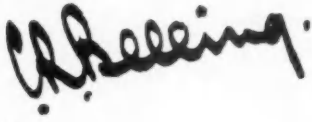
Mr. Coupe, our Works Manager, left us in this year to start in business with a partner in South Wales, making fireclay parts, and has done considerable work for us in this direction since. He was with us some 18 years or thereabouts, starting originally in our Drawing Office.

1937. This year we were full of ideas. One great step forward was the introduction of acid resisting enamel on cooker hobs, which of course is universal today. Then we designed our first Streamline Cooker with the large glass door, thermostatic control, vertical and horizontal models, pedal openers to the doors, etc. We also listed fan heaters and air conditioners, but did not get very far with them.

Our Baby Cooker was further improved by adding a door to the warming cupboard, and arranging for a warming compartment underneath the cooker itself. The price was increased to £4 19s. 6d.

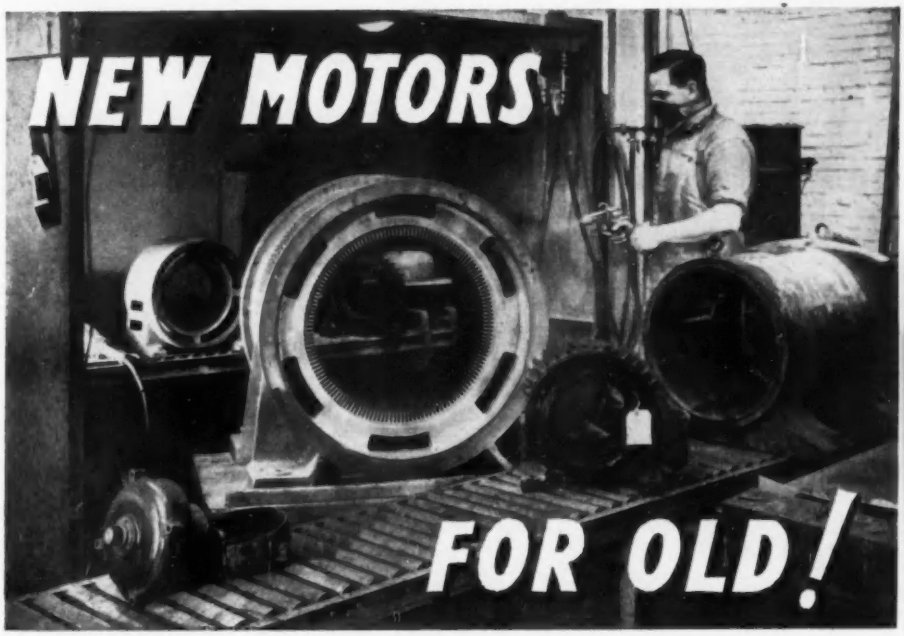
In 1937, too, we celebrated our 25th anniversary and had a grand time at the Royal Theatre of Dancing at Tottenham, where we had a dinner, cabaret and dance. We had about 500 of our people there. They presented me with a splendid travelling case and outfit and an autograph album of the event containing practically all of their signatures. I took this as an opportune occasion to start off our Pension Fund, and gave the Secretary a cheque for £5,000 to get things moving. Incidentally, the Pension Fund is a very great success, and we run the whole scheme entirely ourselves.

Have overstepped my alloted number of words again, so must end.



Belling & Co., Ltd., Bridge Works, Enfield, Middx. Tel.: Howard 1212.

CRCIS



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DIMMERS—REGULATORS (Field, Shunt, Voltage)
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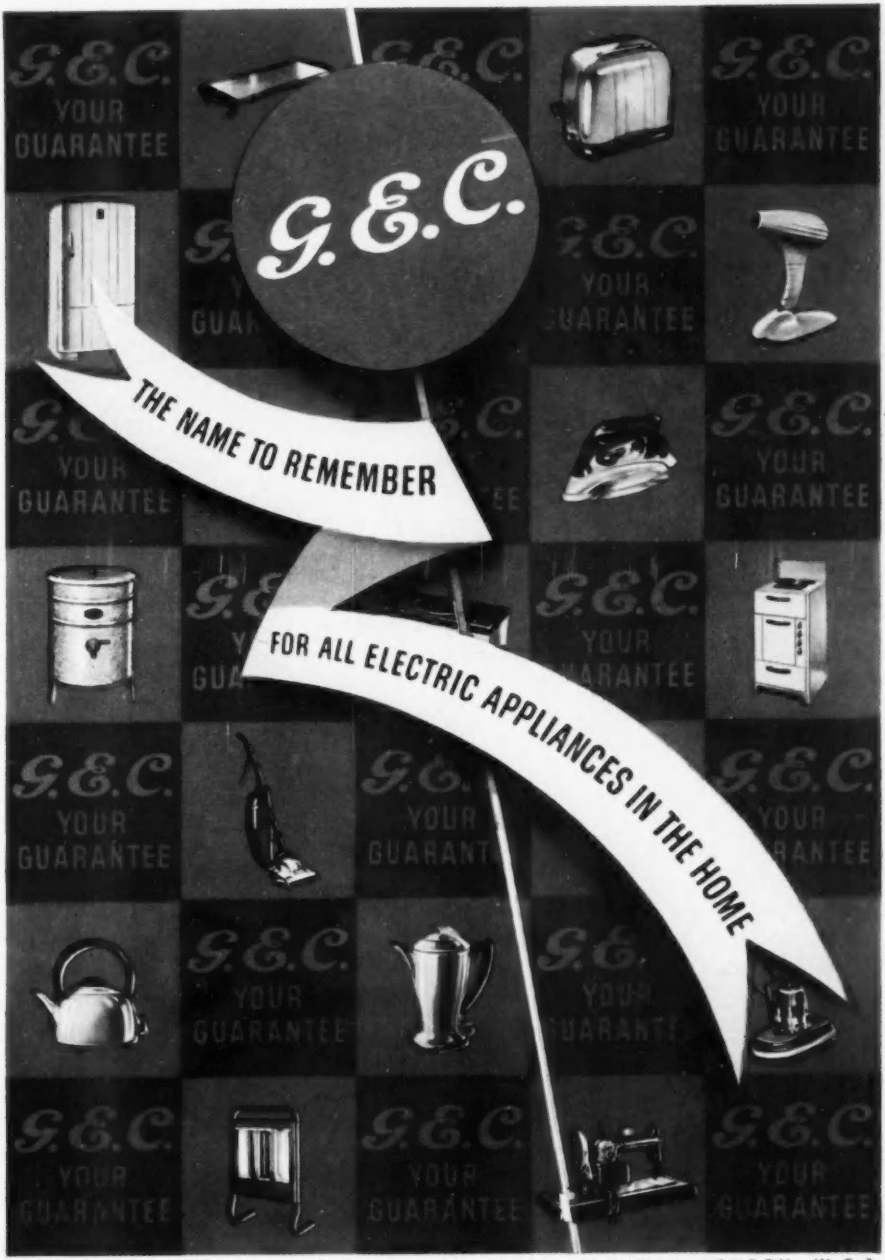

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Thousands like them

in every industry

Parkinson standard A.C. motors

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Distinguished Lighting Fittings in Aluminium Alloy

LIST NO. SW6/I.G. 60 WATT

MANUFACTURED BY

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STOCKED BY ALL LEADING ELECTRICAL WHOLESALERS

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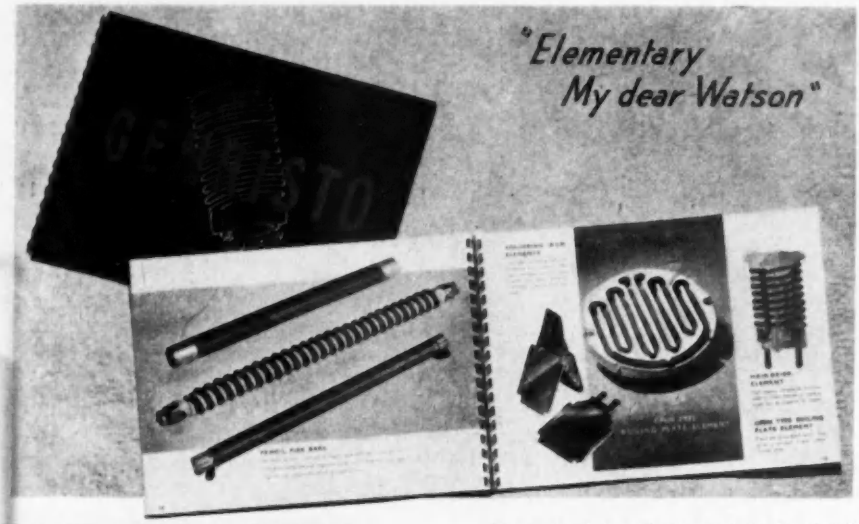

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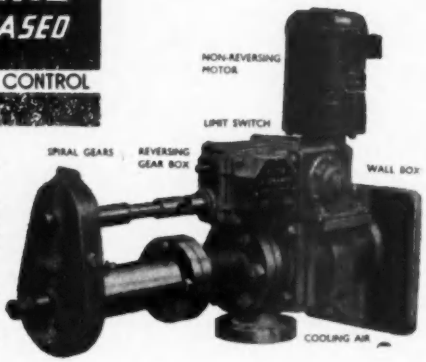
BOILER AVAILABILITY INCREASED

ELECTRO-MECHANICAL OPERATION with SEQUENCE CONTROL



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Metrovick standard type AS 60/24 Spot Welding Equipment.

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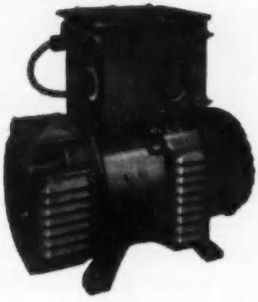

A Metrovick Paradyne Arc Welding Set—available in two sizes 300 ampere or 400 ampere maximum.

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METROVICK *Equipment for More Efficient Welding*

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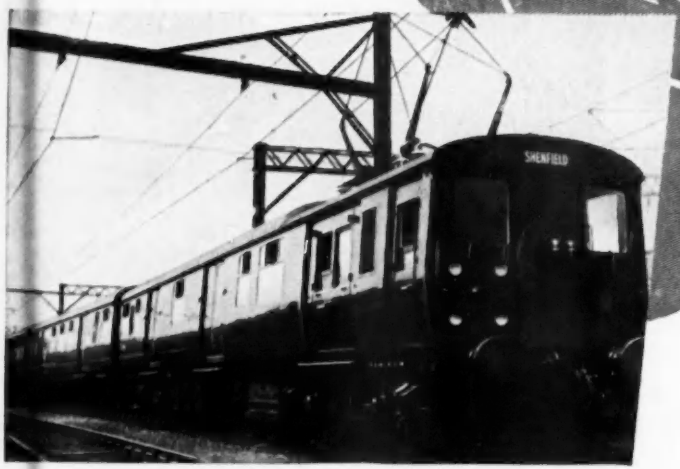

P & G Batteries provide many important auxiliary services to help keep Britain's electric trains running to schedule. On the new Liverpool Street to Shenfield electrification scheme, two of these are switchgear operation and supervisory control. P & G experience is spread over a very wide field and stretches back over 60 years. Specialists who know the battery business throughout will gladly discuss any projects with you. Since two heads are better than one, the results are often surprising. Our 3-point service covers **1.** *Technical Advice and Specifications.* **2.** *Equipment and installation.* **3.** *Regular inspection and report.*

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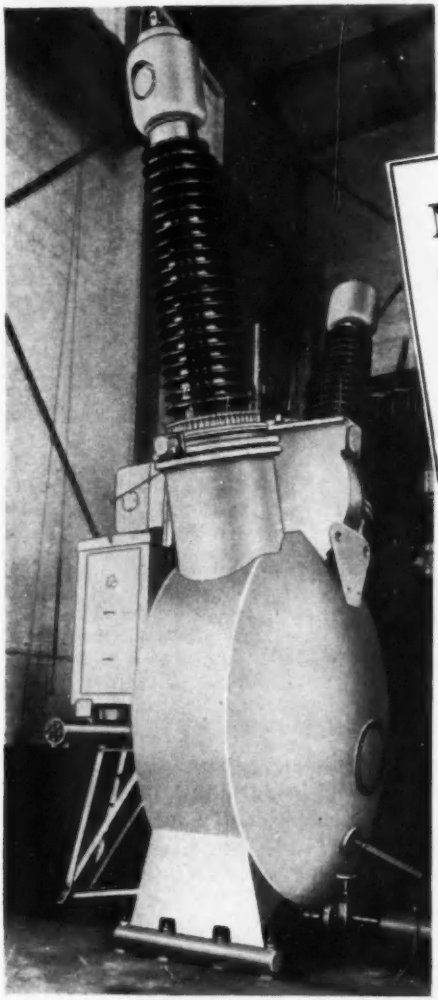
"Shuntarc" 275/300-kV Oil Circuit-Breaker



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7500-MVA
BRITISH RATING

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Tested for breaking capacity on one pole to B.S. 116-1937, the lower current tests being taken with 260-kV recovery voltage across one pole, the higher current tests being unit tests. The circuit breaker is of multi-break construction, each break being shunted by a linear resistor.

The circuit-breaker is suitable for instantaneous auto-reclosing duty.

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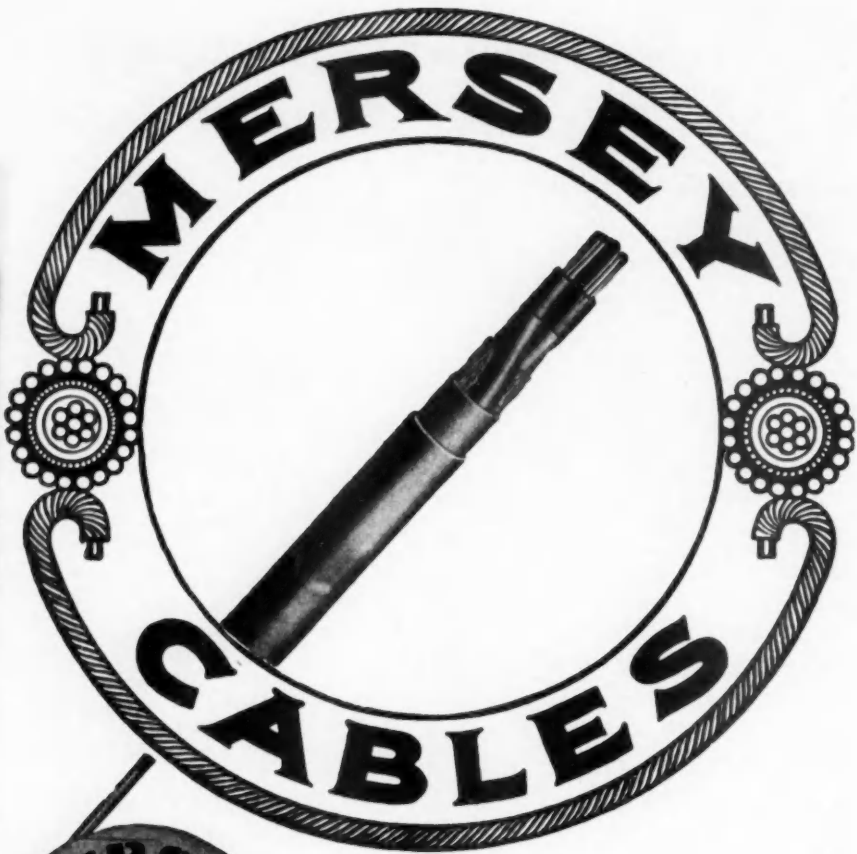

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EVEN A 30 lb BIRD

is not too big

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Jackson

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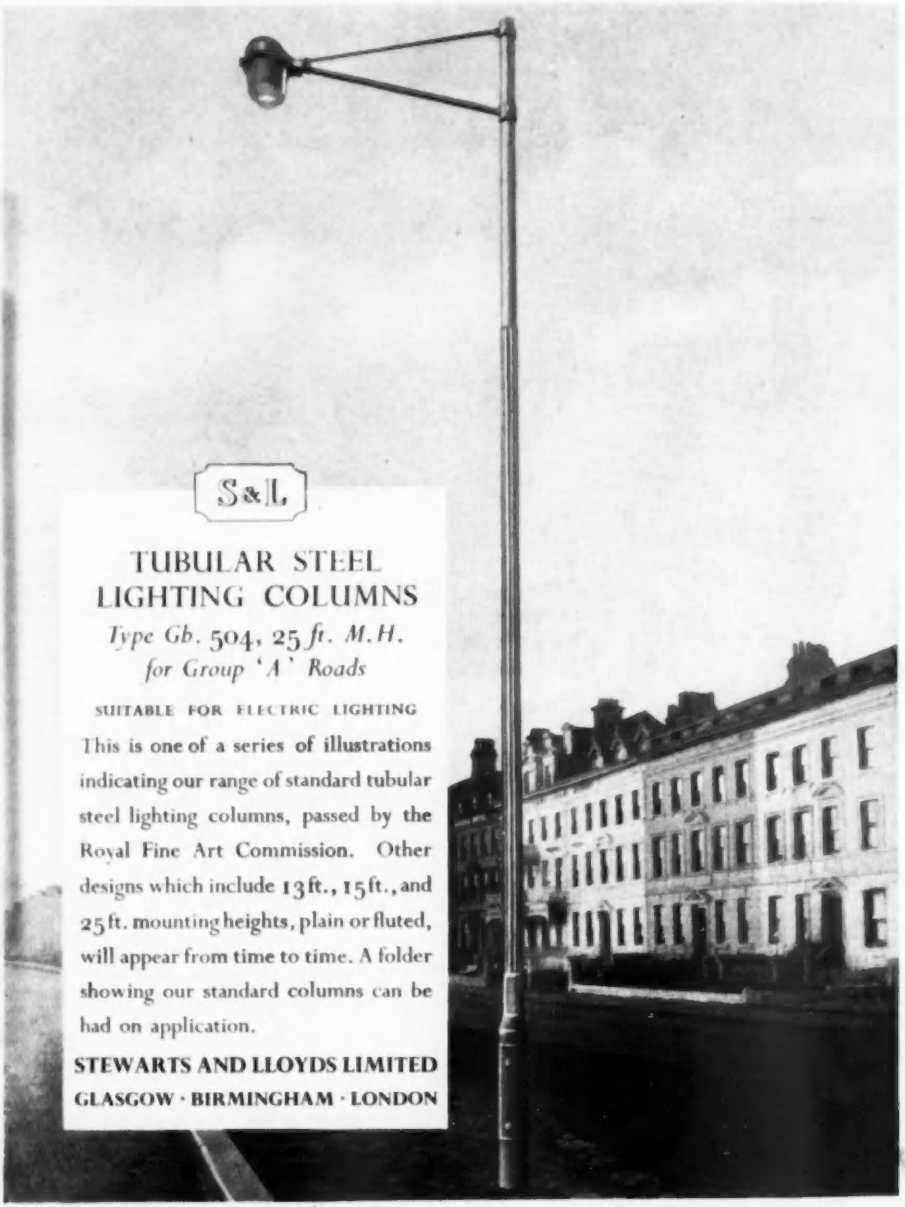
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Type Gb. 504, 25 ft. M.H.
for Group 'A' Roads
SUITABLE FOR ELECTRIC LIGHTING
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has everything that's new in electric cookers

★ RADIANT TYPE HOT PLATE
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COMMODIOUS HOT CUPBOARD WITH SPRING LOADED DOOR
IMPROVED VENTILATOR
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EXTRA LARGE OVEN 3138 CUBIC INCHES
THERMOSTATIC CONTROL TO OVEN
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Special features developed by Carron in the service of cooking efficiency. ★ Optional extras

By Appointment to the Ironfounders to his Majesty

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BY APPOINTMENT
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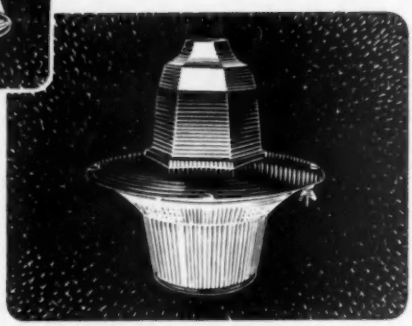

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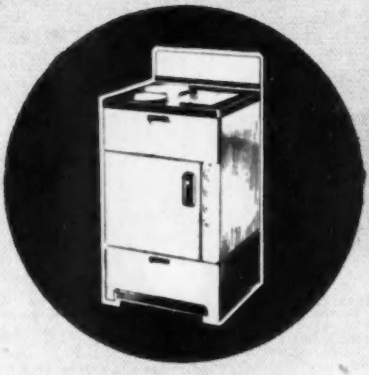

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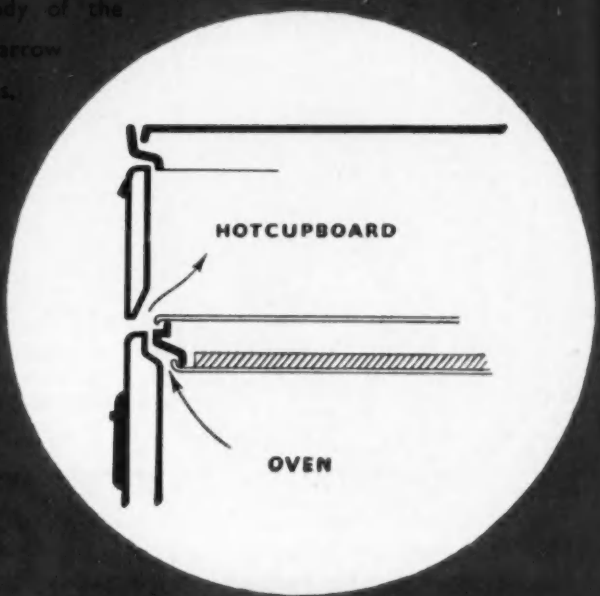

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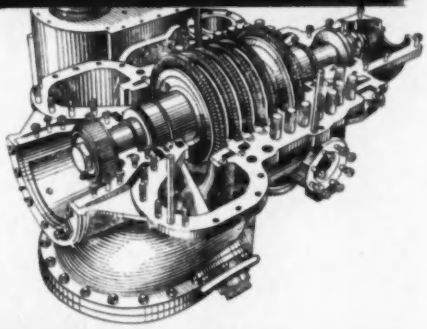

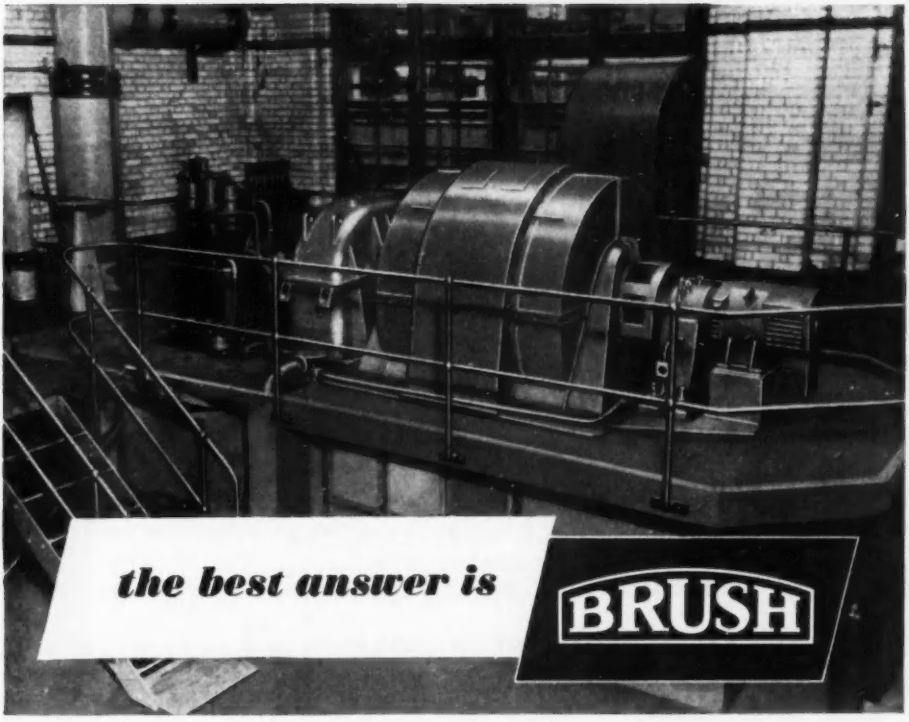

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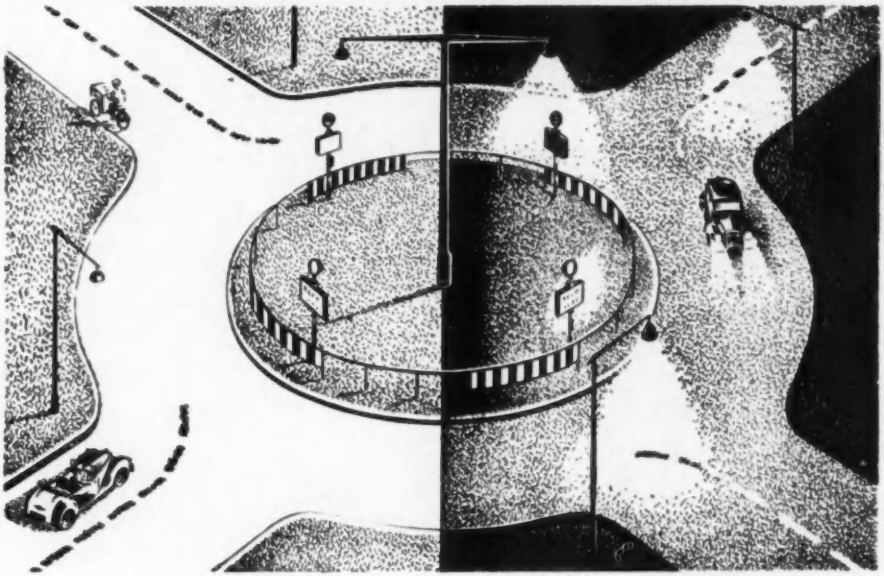

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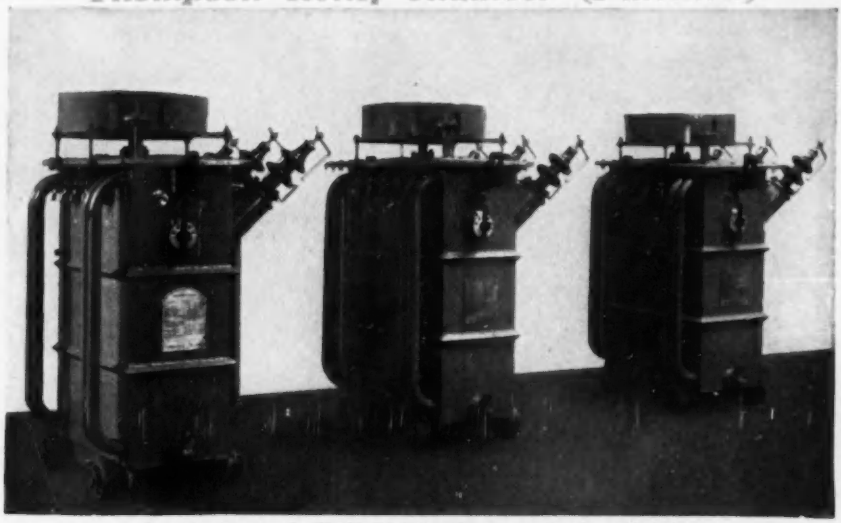

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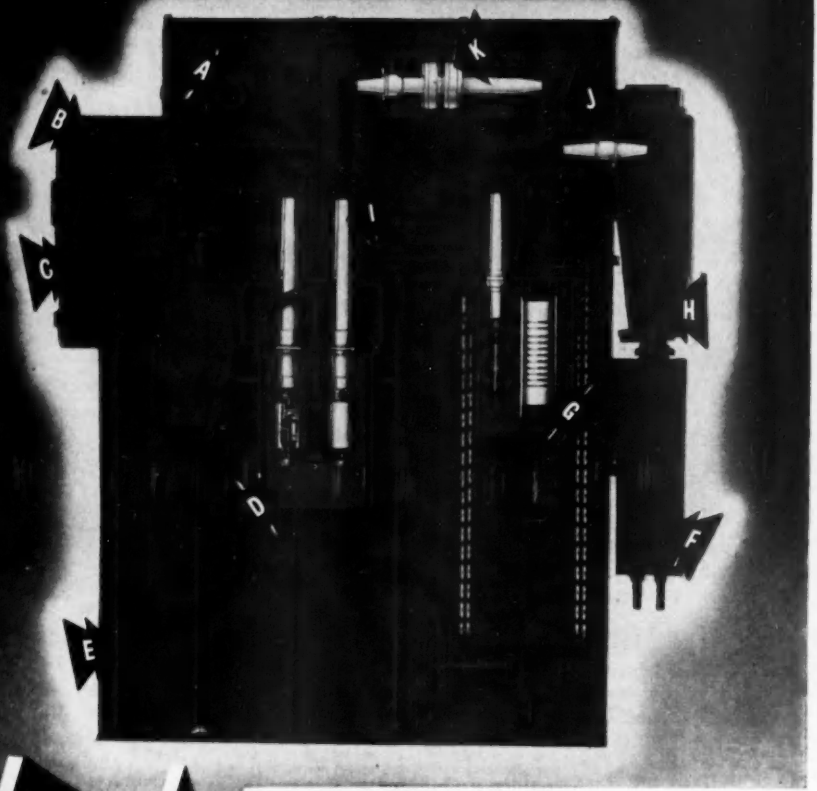

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A Condenser bushing busbars
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C Door giving access to the ancillary apparatus
D Low oil content circuit breaker
E Roller shutter enclosing front of the unit
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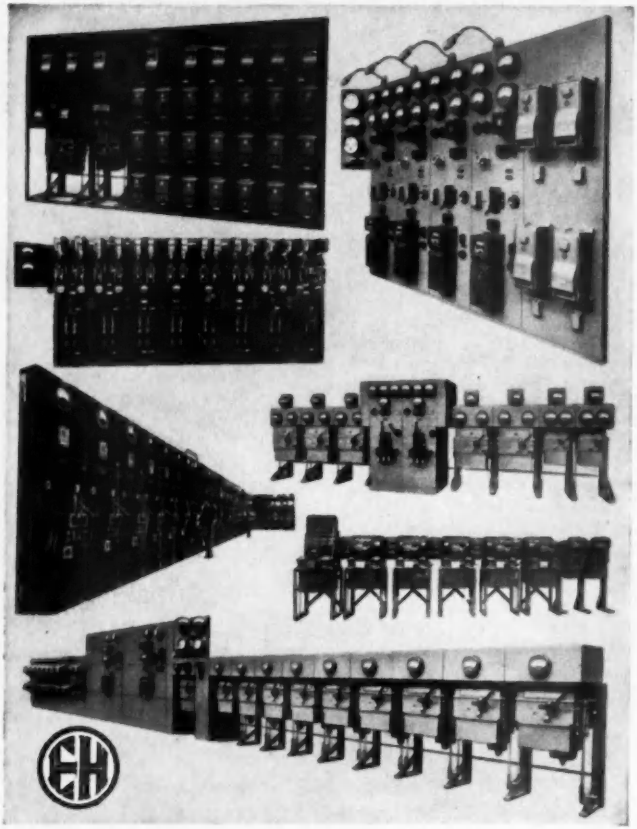

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50 Amps
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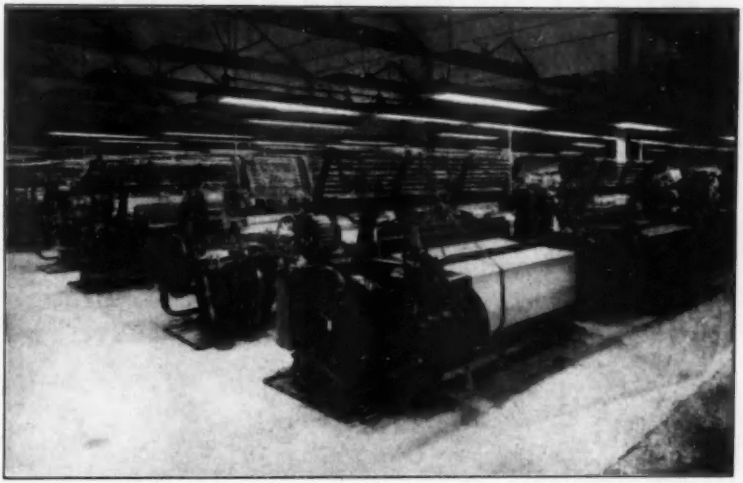

This photograph shows part of an installation of Revo "Trufolite" Reflectors in the Albion Mills of Parkland Manufacturing Co. Ltd. Nearly 500 fittings have been installed in the weaving and warping departments alone.

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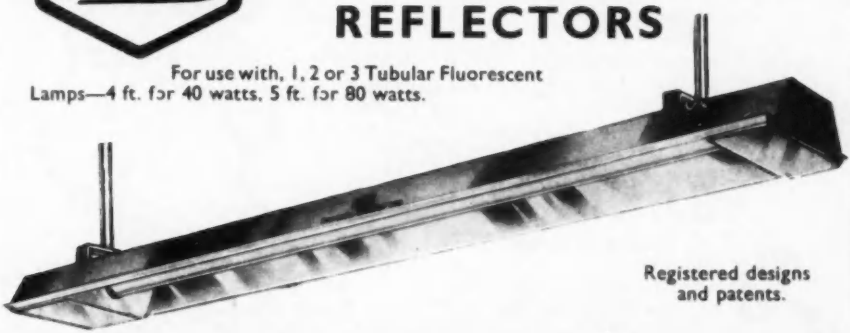

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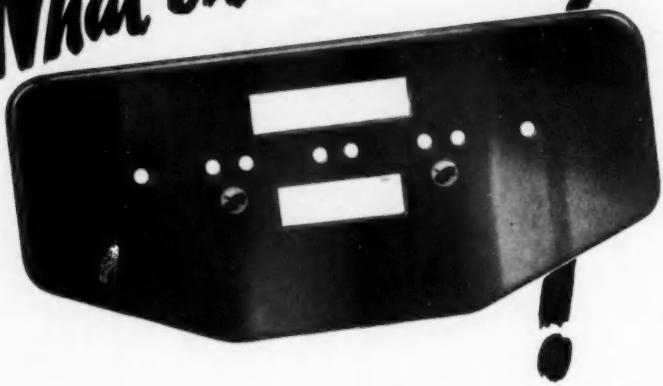

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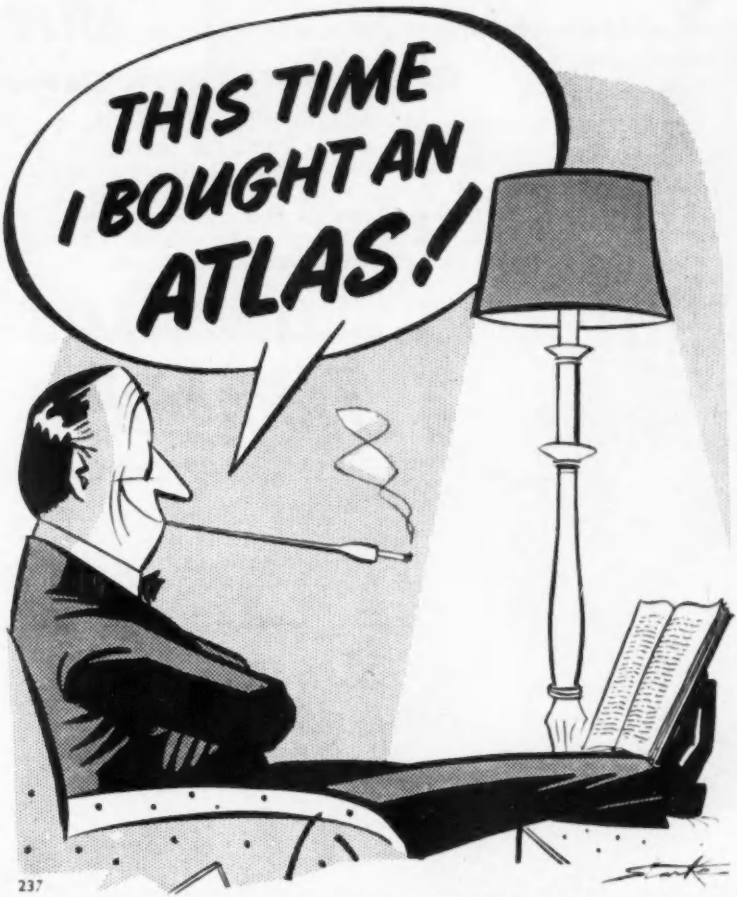

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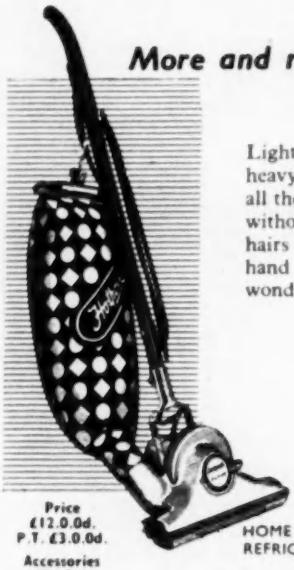

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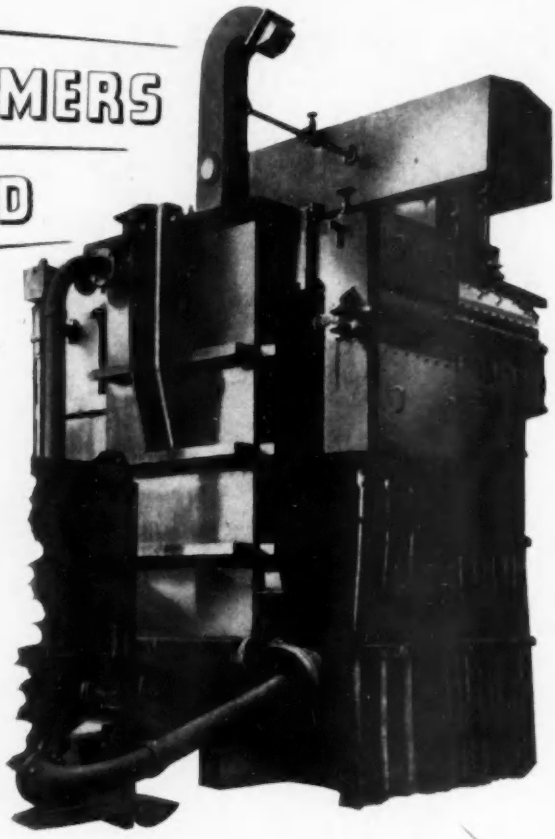

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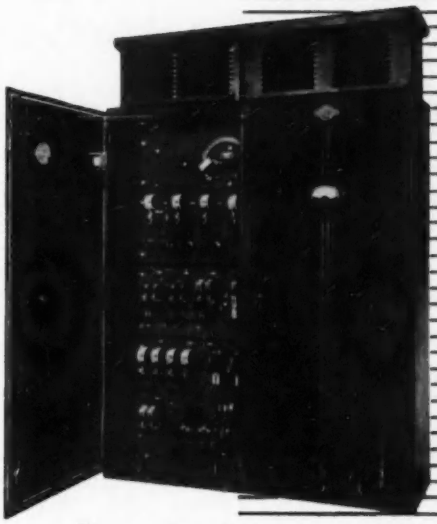

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Single instrument does complete test

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Full details in Publication J 051/22 and 25.

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The purity of distilled water is safeguarded at London and Beeston by Dionic Water Purity Meter installations. Both equipments are fitted with alarm pattern indicators which operate a warning hooter.

For details of Dionic instruments, send for Publication J 216.

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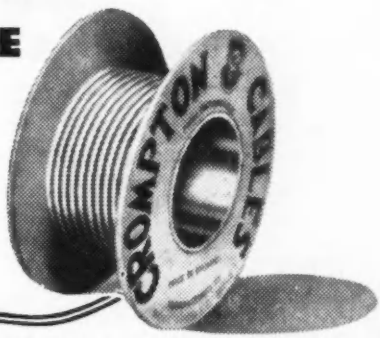

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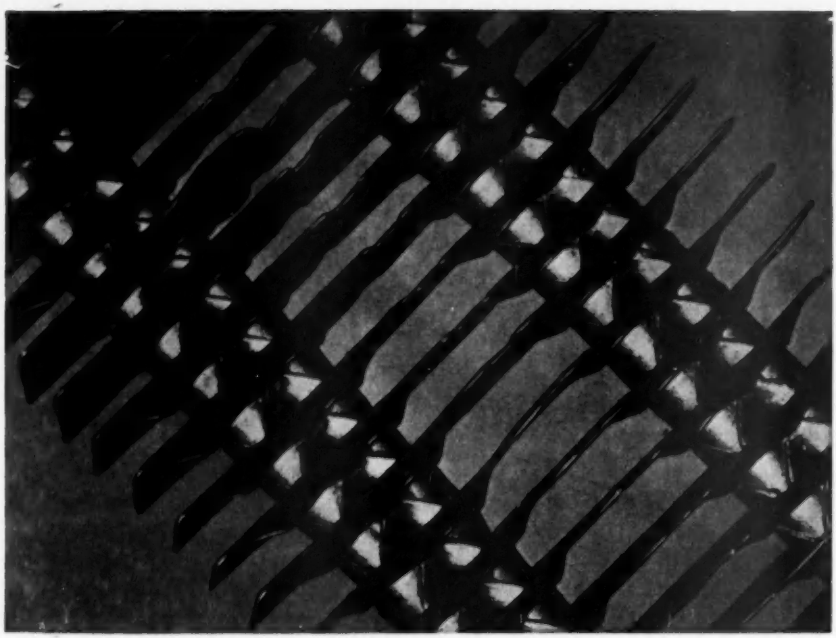

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The brass tube and copper gills of this refrigerator condenser are first fluxed with Frysol Black Band Soldering Fluid and then dip-tinned by complete immersion in Fry's No. 3 dipping solder.

Fry's Technical Leaflet No. 10, which deals with "Solders for Dipping Work," will gladly be sent to those interested.

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ELECTRICAL TIMES

Vol. 118 No. 3076 THURSDAY, 19 OCTOBER, 1950

PUBLISHED EVERY THURSDAY

FIFTY-NINTH YEAR OF PUBLICATION

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Editorial

OVERLOAD ON RESEARCH

WAR-TIME glamourisation of the "back-room boys," together with the accompanying display of what the scientific method could produce under the forcing-house conditions of a national emergency, have made research fashionable. The plodding work that is necessary in the early stages of most investigations is not so well publicised, and there is a tendency to over-estimate what the scientist and the research engineer can solve in a given time. This has attracted the attention of the distinguished group of scientists who form the Advisory Council of D.S.I.R., and they view with concern the uneconomic use of our limited research facilities which results from the various investigational teams taking on too much. No doubt there are many industrial laboratories where similar pressure exists, and the directors and executives responsible for financing them should ponder the warning that there must be constant guard against undue dissipation of scientific effort. There is a tendency to look for a quick and sure return from the money that has been invested in research. The research team, like many electrical machines, has a maximum economic rating that is less than its maximum possible output.

SIMPLIFIED WATER HEATING

IN his address to the I.E.E. Utilisation Section, Mr. A. N. Irens drew an analogy between the gasometer and the thermal storage water heater as a means of storing off-peak energy. Rather to our disappointment, however, he did not emphasise the necessity of fostering this load by means of preferential tariffs. Most of the recommendations made on this much-discussed subject complicate the issue by advocating, as a matter of course, separate metering and time switch or supervisory control, thus adding considerably to the cost of installations. It seems to us that the domestic water-heater is very largely a natural off-peak load—with the possible exception of washing day, most of the hot water in the average household is consumed during the evening. If we accept this, then all that is necessary to foster the water-heating load is to give consumers a discount on the bill based on the normal use of water heating. Average figures should not be hard to estimate, and such a concession would give a much-needed fillip to the water-heating load.

THE GEYSER BOGEY

IN our first special domestic number published as long ago as March, 1913, a review of water heating included notes on the instantaneous type of water heater, which, it was prophesied, would be commonly supplied in ratings of about 25 kW, although the article pointed out that mains engineers were not quite ready for domestic loads of this size. Are they ready now—after thirty-seven years? Throughout, it has been the policy of the supply industry to discourage this use of geysers, by the direct promotion of thermal-storage heating. Now, however, the absence of favourable tariffs combined with the high purchase tax is once more encouraging thoughts of instantaneous geysers, and already designs are available in the smaller type of sink heater. Surprisingly, they are no cheaper than an equivalent thermal storage type, but, should the demand increase, their inherent simplicity should lead to lower costs and the instant availability of hot water without storage losses would have an irresistible sales appeal. Should development travel along these lines, it would be disastrous for the supply industry, yet we cannot continue indefinitely to trade on the goodwill established by the thermal heater

in the past. Some tariff concession is as essential as it is urgent.

EASING THE SQUEEZE

BEAUTIFUL as the I.E.E. building undoubtedly is, few could deny that with its ever-increasing membership, it is getting more than a little tight at the seams. Older members who can recall the days when the lecture theatre was seldom full, now look a trifle askance at the fierce competition for space whenever the occasion is of more than sectional interest, and the climax must have been reached when, on the occasion of this year's Presidential Address, not only the lecture theatre, but even the overflow meeting in the smoking-room had to put out the "House Full" boards. Although the speech was relayed by loudspeaker to the overflow meeting, and the lantern slides were shown immediately after appearing in the lecture theatre, we feel that this is not enough. There seems to be a case for industrial television, i.e. the closed-circuit arrangement with camera and screens linked by coaxial cable. Such arrangements have already been used for televising operations, observing dangerous industrial and atomic processes, and many other forms of remote observation. Repeaters in the I.E.E. would allow of much larger audiences, since no trouble would be experienced in relaying the lecture to several rooms in the building, if necessary. Television equipment is not cheap, we know, but if (as reported in these pages some time ago), the Brilliant generating station in Ohio can employ it to watch water gauges and fuel burners, surely it is worth consideration to reduce the problems of overcrowding at the world's largest professional institution?

A LOST VIRTUE

OF all electrical appliances, machines and instruments, the incandescent lamp is the most easily understood. A current, a hot wire, lots of light, and nothing to go wrong. Manufacture may present difficulties, and the starting current rush has been known to raise interesting problems for the expert in protective gear. In general, though, the electric lamp is welcome as the outstanding example of a unity power factor load, and for the average engineer does nothing but good. Some degree of non-linearity has been the only snag, but now the lamp's reputation as a paragon of the electrical virtues is being questioned by our American colleagues. They allege that the older type of lamp, the one which has an element free from the advanced complication of coiled-coil, is guilty of generating television interference. The hanging wire, they say, vibrates on its supports, and by a complicated series of events radiates electromagnetic waves. More modern varieties offend by some strange action of the frosting applied to the inside of their glass bulbs. So perhaps we must look for another favourite for the No-offence Stakes.

BLACK AND WHITE

MOST of us are by now familiar with the photo-electric smoke indicator which, by projecting a beam of light through the chimney on to a photo-electric cell, can be made to give a remote indication of the density of the smoke, thus taking the place of trained observers with Ringelmann charts. Now, in addition to measuring the blackness of black, the photo cell is being employed to determine the whiteness of white. On our recent visit to the Laundry Exhibition, we were shown a photo-electric comparator which, by comparing the reflectivity of a laundered surface with a standard whiteness disc as approved by the British Laundry Research Association, gives a direct reading of what the laundry trade calls "colour." As we struggle into our dress shirts for the next I.E.E. dinner, let us hope that our laundries have bestowed upon them that snowy sheen which is the hallmark of the well-dressed diner-out, and that it will not be our lot to stand in crimson-eared embarrassment like the grey-clad individuals in certain famous posters, to overhear the remark . . . "Somebody's laundry isn't using an electroselenium comparator!"

Meteor

High-Temperature Lamp Seals

Developments in a Quartz-Molybdenum Seal of the Houskeeper Type

by E. J. G. BEESON

UNTIL recently the only practical solution to the problems of carrying heavy current into a fused silica (quartz) envelope at high temperature has involved fusing thin molybdenum foil through the quartz. This type of foil seal is widely used in the manufacture of discharge lamps today and a high state of perfection has been reached in its construction, but when current-carrying capacities of about 150 amps and over are required a foil seal becomes large, complex and also costly. It is for these reasons that a new quartz-molybdenum member somewhat similar to the Houskeeper form of glass-metal seal has been developed. Such a quartz-molybdenum seal was first described by Greiner and Peters, of the Lamp Development Laboratory of the G. E. Co., U.S.A.[1], using a cup machined from a rod of molybdenum. The seal described in the present article makes use of a cup pressed from molybdenum sheet.

The seals described here have been developed for use with very high wattage mercury and gas discharge lamps; the seals must, therefore, not only carry the heavy current required, but must operate in air at temperatures around 350° centigrade, contain no pockets where mercury or other metals may condense, and be mechanically robust.

Fundamental Problems

The range of metals suitable for sealing direct into quartz is restricted because of its low coefficient of expansion and its high refractory nature. Although molybdenum has an expansion some ten times greater than that of quartz, its high melting point and ability to be rolled into thin foil make it almost uniquely suitable for sealing to quartz. The initial development work on the foil-type seal was due to Gabor.[2] It was found that if molybdenum foil was made of thickness not greater than 0·0006 in. a seal,

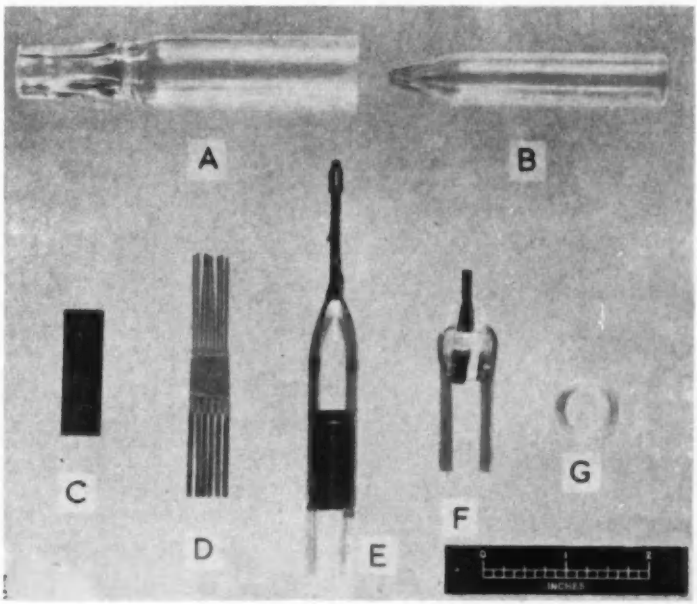

Fig. 1. Components and assembly of the molybdenum foil quartz seal

(A) and (B) main quartz components forming body of seal. (C) molybdenum foil. (D) foil assemblies after treatment. (E) assembly of electrode rod and foils. (F) cross-section of seal along its axis. (G) cross section at right angles through seal

vacuum tight over a wide range of temperature, could be made when the walls of a quartz tube were collapsed on to such a strip under vacuum.

The current-carrying capacity of the foil seal is determined by the area of cross section of the foil, and small seals designed to carry 2-5 amps are today manufactured in large numbers on automatic machines for some of the smaller high-pressure quartz mercury vapour lamps.

Further development of this seal showed that foils 0·0025 in. thick could be used[3], giving three to four times the increase in current-carrying capacity providing the cross section of the molybdenum strip was made elliptical instead of rectangular. Electrolytic etching of this thicker strip provided a ready means of producing the desired shape.[4] When seals were required to carry higher currents, a number of these foils, or a single wide foil, was arranged around the circumference of a quartz tube, and while such foil seals have been made which carry currents of up to 300 amps, the diameter of the seal becomes large and the quartz costly, and the seal is complicated to make. The Houskeeper seal,[5] familiar in glass-to-metal seal construction, unlike the molybdenum foil seal, carries no current and therefore presents no limits to current-carrying capacity. The basic element of the Houskeeper seal is a knife edge of base metal, usually in the form of a thimble. On to this tapered metal edge is fused a layer of glass to form the hermetic joint as well as the means of joining this to a glass envelope. The closed end of the thimble may have heavy metal rods welded to it, or through it, to carry the current.

Foil Seals

Before describing in more detail this quartz-molybdenum Houskeeper seal, the basic construction of the existing foil seal in its application to discharge lamps[6] and some of its limitations will be described.

In Fig. 1 is shown the build-up of a foil-type seal. Two quartz components (A) and (B) form the main structure of the seal. The molybdenum foil (C) is cut from 0·0035 in. sheet material to the width and length required. After subsequent treatment in various electrolytic and acid etching baths, reinforcing strips of molybdenum are welded on to it and one or more foil assemblies (D) are mounted on the inner quartz tube (B). In addition the electrode rod, which is mainly tungsten in a discharge lamp, is welded to the reinforcing strips of the foil as shown in (E). This assembly is inserted into the outer quartz component (A), and a preliminary seal made at the outer end of the two tubes so that the annular space between the two tubes can be exhausted to a hard vacuum from the other end. This assembly is strongly heated in an oxygen-coal gas flame, causing the outer tube to collapse on to the inner tube, sealing into the quartz the molybdenum foils, the reinforcing strips and the rod. While there is an intimate contact

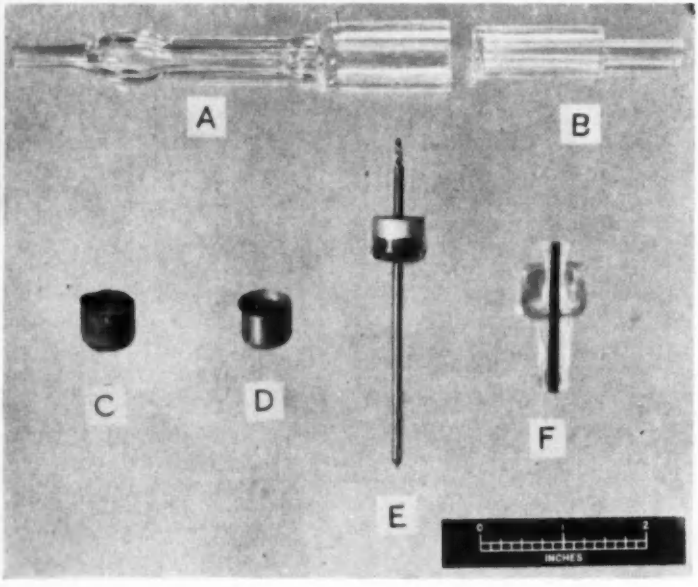

Fig. 2. Components and assembly of the Houskeeper quartz-molybdenum seal

(A) and (B) main quartz components forming body of the seal. (C) molybdenum thimble as drawn. (D) molybdenum thimble after grinding and etching. (E) thimble joined to tungsten rod and wrapped with foil. (F) cross section of seal along its axis

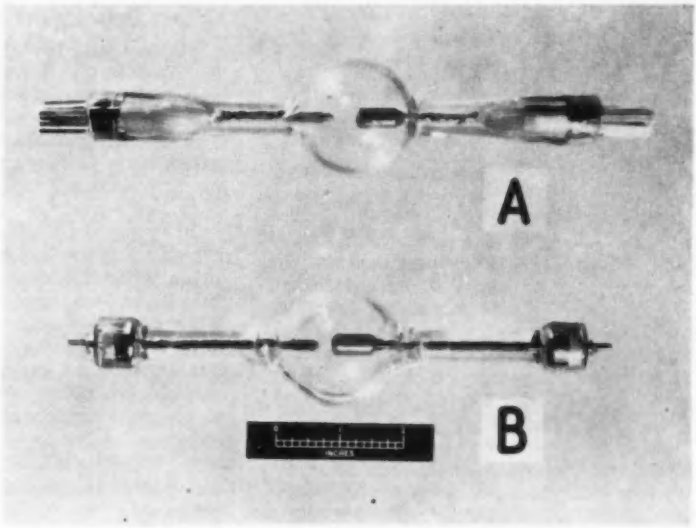

Fig. 3. (a) 1-10 kW Type ME compact source lamp

(A) shows lamp with foil type seals. (B) with Houskeeper type seal

between the quartz, the reinforcing strips of molybdenum attached to the foils and the rod, they do not form a vacuum-tight seal, but only that portion of the molybdenum foil which has been treated and suitably shaped. A wetting action takes place between this foil and the quartz, giving it its hermetic properties. The quartz tube in which the foil is embedded is sufficiently strong to withstand the stresses during a temperature change, while in a direction across the foil the metal is sufficiently ductile to absorb the difference in the relative expansion. Excess quartz at each end of the seal is removed to permit suitable caps and electrodes to be fitted. The outer quartz portion can then be sealed on to a quartz envelope or bulb to form a complete lamp body as shown in Fig. 3A. Two cross sectional views of the seal, one along its axis, and the other at right angles through the seal itself, are illustrated in Fig. 1 (F) and (G) respectively. These show how current is led into the lamp from the external strips through thin foils to the tungsten rod which carries the electrode, the thin foils forming the vacuum-tight seal.

Details of the Houskeeper Seal

Similarly, Fig. 2 shows the arrangement of the quartz-molybdenum Houskeeper seal. Again the two quartz components (A) and (B) form the main structure of the seal. The molybdenum thimble (C) is produced by drawing from a 0·010 in. thick sheet material. This thimble measures $\frac{3}{8}$ in. in diameter by $\frac{1}{2}$ in. deep and, after annealing, both the internal and external surfaces are ground to a suitable taper and then treated in electrolytic and acid etching baths. The finished thimble is shown in Fig. 2 (D). A hole is punched through the closed end of the thimble to permit a 3 mm diameter rod of tungsten to be passed through, and the joint is made vacuum-tight by fusing with platinum or a platinum alloy. Here again, there are very few metals which are suitable to make this joint; it must be resistant to attack by mercury, have preferably a higher melting point than the temperature at which quartz is collapsed (approximately 1,600° C.) and be reasonably resistant to oxidation.

All metal surfaces in both the foil and thimble assemblies, other than those at which the actual hermetic seal is made, are wrapped with very thin molybdenum foil to prevent adhesion of the quartz which would then crack. A molybdenum thimble joined to its tungsten rod is shown in Fig. 2 (E) together with its foil wrapping. This is inserted in the quartz component (B) followed by (A). Again a provisional seal is made between the two quartz parts at the end of the tubes adjacent to the thimb'e, allowing this to be exhausted to a hard vacuum from the remote end. The quartz is heated in an oxygen-coal gas flame and collapsed down on to both sides of the molybdenum thimble as well as on to the tungsten rod. The actual seal portion of the thimble is subjected to as high a temperature as possible to ensure perfect sealing qualities. Although the resultant seal has a bright surface when made, it has been shown by tests carried

Fig. 4. 10 kW Type ME compact source lamp

out in the development of the Houskeeper quartz seal that a molecular oxide bond exists between the metal and the quartz which makes it vacuum-tight. After making the seal, excess quartz is removed so as to expose the tungsten rod at each end. On one end of this rod is mounted the electrode, the other end having either a cap or flexible lead attached to it for leading in the current.

A sectional view at right angles to the axis of the seal is shown in Fig. 2 (F), and this may be compared with Fig. 1 (F) to see the relative advantages of the Houskeeper type in its ability to carry currents no longer limited by the current-carrying capacity of a thin metal foil. A lamp using the Houskeeper quartz-molybdenum seal is shown in Fig. 3 (B). Both of the lamps illustrated (Fig. 3a and 3b) are 1-10 kW high-pressure mercury vapour compact source lamps, and some of their more important characteristics and their applications have already been published.[7] The lamp has a normal rating of 1,000 watts and takes a current of 16 amps with an arc voltage of 60-75 V. It is designed to be pulsed up to 10 kW for one second at a current of 120 amps. The foil-type seal in this case is designed to carry a steady current of 30 amps, while the Houskeeper seal will carry 150 amps continuously. This same seal could therefore be used, with a slight change in its overall length, for a 10 kW continuously-rated compact source lamp, one of which is shown in Fig. 4 with the more familiar strip foil seals. The Greiner and Peters thimble seal has also been used in the development of a 5 kW compact source lamp in the U.S.A.[8]

Other Developments

It is interesting to mention other quartz seal developments that are taking place. A flat disc type molybdenum-quartz seal, described by Nelson,[9] and developments by Peters [10] of the G.E. Co., using an annular corrugated disc of molybdenum to overcome the radial stresses associated with a flat disc quartz seal, offer an interesting design.

Other quartz to metal seals using a single[11] intermediate glass between a tungsten wire and quartz are used in the making of water-cooled mercury vapour lamps. The size of this wire is limited in diameter to about 0·030 in. owing to the inherent mismatch in a seal of this type. The use of a number of intermediate glasses, normally 3 to 5 glasses, enables satisfactory seals to be made between a borosilicate tungsten sealing glass and quartz capable of carrying heavy currents, but they are not designed to withstand high internal pressures. Developments, however, on these lines have already shown the possibilities of using a series of graded glasses or a number of sintered glass discs to seal large diameter tungsten rods 6 mm in diameter into a quartz envelope and capable of withstanding the internal pressures associated with high pressure mercury vapour lamps.

The reliability of the Houskeeper glass seal is well established, and in its recent development in the form of a quartz to molybdenum thimble seal it has features which surpass other previous types. The application of this seal to compact source Xenon discharge lamps, which require high currents, have already enabled higher efficiencies to be obtained due to lower seal losses. It should also be of considerable value in other applications.

I should like to thank those of my colleagues who have contributed technique and skill in the development of this seal and also to thank Mr. L. J. Davies, Director of Research, B.T.H. Co. Ltd., Rugby, for permission to publish this article.

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Our readers' views . . .

Insulation Resistance

MEGOHM, in his article, "T.R.S. Wiring," in your issue of October 5, discusses a particular installation which, he states, after having adjustments made to it, had an insulation resistance of 500,000 ohms. He proceeds: "Although this value is, in fact, only one fifth of the permitted minimum. . . ."

May I enquire on what grounds or what regulations does he base this figure?

Regulation 1103A of the I.E.E. states that "the insulation resistance need not however exceed one megohm for the whole installation."

If the figure is obtained by reference to Reg. 26 of the Electricity Supply Regulations, which states that the leakage current shall not exceed one ten thousandth part of the maximum current to be supplied to the installation, the maximum current would appear to be very small.

E. Wood
A.M.I.E.E.

HUDDERSFIELD.

◆ ◆ ◆

IN reply to Mr. Wood's letter, the figure of 500,000 ohms referred to one circuit only, part of an installation. I.E.E. Regulations 1103 and 1104 (twelfth edition) require a value not less than 50 megohms divided by the number of points, i.e. 50 divided by 20, or 2·5 megohms in this case.

Megohm

◆ ◆ ◆

300 kV Circuit-Breakers

THE article by Mr. Pollard on "Circuit-breakers for 300 kV," in your issues for September 14 and 21, is very interesting and gives a comparison between the performance of the oil-break circuit-breaker with and without shunting resistors. There is no reference however, to modern designs of oil-break circuit-breakers which do not employ resistances, but which have an oil injection feature.

G. E. Simpson

NORTHUMBERLAND.

(It must be borne in mind that the author was describing the methods adopted by one particular organisation, which considers that the problem can best be solved by the normal volume oil circuit-breaker using resistance switching.—ED.)

Leakage Currents

YOUR article of August 17, on checking leakage current, reminds me of an experience I had in 1946 whilst staying in furnished rooms at a South Coast resort.

I repaired an electric heater and duly tightened up on eof the pins of the two-pin plugs. On switching on, nothing happened, and the lady of the house explained that her husband had slackened off the pin so that it would "reach the large hole," i.e. the earth socket. I found that the neutral connection from the electric oven D.P.S. to the three-pin socket was broken.

I fitted a three-pin plug and earthed the heater and asked the good lady how long the heater had operated in the above manner and she replied: "Oh! Several years." Thus a good 7·5 amp had been leaking to earth for a considerable period.

K. Coombs
A.M.I.E.E., A.M.I.Mech.E.

LEICESTER.

◆ ◆ ◆

Shunts v. Transductors

METEOR, in his paragraph "No Shunts for Aluminium" (Oct. 5), raises the question of the loss of over-current protection when using a transductor, in case of failure of the a.c. supply. He then suggests that an emergency relay could be operated directly from the magnetic field around the conductor.

This arrangement has actually been applied to my own knowledge some years ago—before transductors were ever heard of. All that is necessary is an instantaneous relay of the attracted-armature type, which can be of the simplest construction. No winding is required, but the normal iron circuit of the relay is extended to form a closed loop surrounding the busbar. Since d.c. is being considered, there is no need even for a laminated core, all that is necessary is that it should be of sufficient cross-section to avoid saturation at normal overloads. Since the busbar voltage on a heavy d.c. system is not likely to exceed 500 V max., there is no need for insulation other than for the actual tripping contacts, in fact the entire device can be as simple and cheap as could possibly be imagined.

E.K.

LONDON.

MAINTENANCE METHODS—No. 2

Motors and Machine Shops

Comprehensive records of electrical apparatus and maintenance routine reduce failures at Albion Motor Works

MANY different engineering processes are involved in the manufacture of heavy road vehicles, with machine shop operations predominating in importance. It is not surprising, then, that a methodical maintenance system for small motors and their control gear is the outstanding feature of the electrical department of the Albion Motor Works Ltd., Scotstoun, Glasgow. Many other aspects of the work here are of interest to maintenance engineers generally, and are described in the following article. A survey of the Company's electrical supply and distribution system places them against a correct background.

Main Substation

The Albion Motors factory covers 13 acres of ground, set back from the Clyde on its north bank. With a production floor space of 470,000 sq ft, the works house facilities for all stages of internal combustion engine building, and vehicle manufacture and development, with the exception of coachwork. To provide electrical power for the processes concerned, a supply is taken at 11 kV from a ring main serving this industrial section of the city and three 1,000 kVA transformers are installed to give a 440 V, 3-phase at the bus-bars of the works' main control board. All works distribution is carried out at this voltage.

A raised steel platform in the electrician's room carries the switches and other apparatus for controlling the factory system, the bus-bars tracing three sides of a rectangle. The bus-bars are of interleaved copper construction, and are normally run in three isolated sections, corresponding to the three sides of the rectangle, and each section fed by a separate transformer. Knife switches are used as off-load bus-couplers to provide a supply to dead sections should any transformer be out of service.

Ellison switchgear was installed when the substation was built many years ago, the circuit breakers concerned being nominally rated at 7 MVA short circuit capacity. Although these switches continue to give satisfactory operation for normal switching duties, they would now be inadequate in the case of a severe fault, and so they have been backed up by English Electric Co's h.r.c. cartridge fuses, of the indicating type, which are rated for 25 MVA short circuit duty.

Power and lighting circuits are fed separately from the main board, the breakers on the lamp circuits being painted red to distinguish them. Since large capacitors placed at the end of cable runs are used for power factor control in the factory, push button switches for operating the contactors connecting these capacitors are provided near the appropriate circuit breakers, so that effective regulation may be obtained when large load changes occur.

Metering equipment for both the Company and the Area Board is mounted on the control platform, and in addition there is a recording ammeter connected in the earth circuit to measure leakage current. Reference to the use of this instrument in maintenance procedure will be made later.

For emergency use, and to allow the load on the public mains to be reduced, generating sets powered by Albion oil-engines are installed at six different sites in the factory. Each prime-mover drives two d.c. generators which can be switched in to supply the lighting circuit in the area concerned.

Factory Distribution

Distribution within the factory is normally carried out in conduit to centrally placed distribution boards. At present the factory is in a state of transition, with individual drives for machines replacing overhead shafting, so the situation beyond the distribution boards varies considerably. A considerable length of English Electric overhead trunking is being installed to give supplies to machines, the bus-bars being directly fed by p.i.l.c.s.w.a. cables.

For a new machine shop that is being developed the provision of a small local switchboard has been considered advisable, and this is being fed from the main board by p.i. cables run on hangers along the outside of the building. Johnson & Phillips Ltd. switchgear is used for this new board, which in turn feeds a series of distribution boxes throughout the shop. Factory-made trunking runs from these boxes, and the intention is to run v.i.r.

from the box, along the trunking, and then drop down through conduit to the individual machine. The flexibility necessary in the gradual development of this new shop can thus be obtained.

Mention has already been made of the capacitors used for power factor correction. These remotely controlled units, eight in number, are of B.I.C.C. manufacture, floor mounted, and rated at between 50 and 188 kVA, with a total reactive value of 640 kVA.

Exceptions to the 440 V/250 standard occur for portable tools (110 V, 55 V to earth), individual machine lights (50 V) and repair shop lamps (12 V).

Maintenance Routine

Some 2,000 motors are supplied by the system described above, and their power demand results in a peak loading of over approx. 2,000 kVA, so a high degree of maintenance systemisation is necessary to keep everything running smoothly, with a staff of 12 electricians and six labourers to assist the plant electrical engineer.

Considering motors first, a complete history of each individual unit is kept in card index form in the plant department office. At the head of each card are shown such details as plant number, make, rating details, frame size and general type. All inspections, faults and repairs reported for this motor are noted on the card.

For quick reference when a fault is reported on a machine which incorporates several motors, a second card index is maintained, which below the machine number, records the plant motor number of every unit which it incorporates, its duty, and the date of installation.

These indexes are part of the plant electrical engineer's records : much of the information in them is repeated on a long wall chart kept in the electrician's shop. This lists the motors in numerical order, and also gives the dates of overhauls, of rewinds (with the cause of the breakdown necessitating them), of the trip setting on the starter, and the type of trip, the date on which the starter was overhauled, and, finally, the horse-power rating of the motor.

Routine maintenance is based on a man going out during the lunch break and visually inspecting motors and starters, and testing the winding resistance with a Megger. The work is confined to one area of the factory, and is afterwards indicated on the chart by shading in half of the space provided against the numbers of the motors and starters concerned. Comprehensive overhauls of motors and associated equipment are carried out at about three yearly intervals, the exact time depending on the accessibility of the machine and the convenience with which it can be taken out of service.

During the war-time drive for production, there was little opportunity for maintenance, and so many motor windings became saturated with oil, which, from the electrical view is all too ubiquitous in machine tools.

The standard procedure is, therefore, to stove the motor to drive off the oil from the windings and to wash it in petrol. Hand picking to remove dust, etc., follows, and the windings are freshly varnished and a bakelite preparation supplied.

Details of the action taken during the overhaul are filled in on a slip by the electrician concerned, and later transferred to the card index. The same routine applies to the overhaul of starters, the main point emphasised here being the checking of overload trips and fuses. To facilitate the former, a test device incorporating a Variac transformer has been built, to enable the trip current to be injected into the appropriate starter winding.

Lighting

Illumination levels in the shops generally are kept between 15 and 20 ft candles. Most of the lamps are tungsten filament units with industrial type reflectors, and a regular system of cleaning is in operation, controlled by a board in the electrician's shop on which hang metal discs painted white on one side and grey on the other, Each disc represents an area of the factory, and when this has been cleaned the disc is turned white side up. After a fixed interval, or when observation on the photometer surveys which are undertaken from time to time indicate the need for further cleaning, the disc is reversed, and thus the staff concerned can tell at a glance what work is outstanding.

In spite of routine maintenance, various faults do of course occur from time to time, though motor burn-outs have been reduced to a very low number annually. The standard procedure is for the foreman in whose department the trouble occurs to fill in a plant job card which is then passed to the maintenance section concerned, who take the necessary action. The earth leakage recorder already mentioned gives sufficient warning of growing earth faults to allow many incipient troubles to be dealt with by the electrical department on their own initiative before attention is

drawn to them by breakdowns, fuse operation, or shocks.

Installation Ideas

As a result of operating the system many minor weaknesses in machine design and general practice have become apparent, only a few of which can be dealt with here. The first concerns machine tools, in respect of which there is the usual complaint of inaccessibility of control gear. The small motors driving the suds pumps have been a notable source of trouble, and it is considered that these should always be protected by overload trips rather than fuses, because of their tendency to single phasing, with consequent burning out. Another trouble with these motors is the lack of waterproof quality in the terminal boxes. As a result of this, it is considered worth-while packing the boxes with Henley green compound.

Unit heater motors are likewise considered as specially subject to unequal loading troubles when fused, due to the gradual build-up of dust, and the situation can be eased to some extent by using thermal trips.

On overhead cranes carbon collectors have replaced brass wheels with a noticeable decrease in the amount of maintenance required, and the fitting of carbon tips on the finger contacts of barrel controllers has had similarly successful results. Care is taken, incidentally to paint the isolators of all cranes red, and warning of the excitation of bare trolley wires, is given by connecting red lamps across them at intervals, so that no-one shall unwittingly place ladders, etc, against them. Red paint is used liberally on all earth continuity and bonding conductors, so that any mechanical damage is at once noticeable.

Standardisation

An attempt is being made to standardise the electrical equipment used in machine tools, and where acceptable to the manufacturer Albion Motors Ltd. supply a standard make of totally enclosed motor. If some other frame type is called for, the windings must be impregnated against oil vapour. Equally, starters are supplied where possible, direct-on line up to 15 h.p. and star delta on auto-transformer above that. Preferred manufacturers for all these units are listed, and also for the equipment of automatic control panels.

We are indebted to Albion Motor Works, Ltd., and to the Director and Works Manager, Mr. William Pate, for facilities for inspecting the factory.

High Permeability Alloys

THE theme of the Measurement Section's Chairman's Address, delivered at the I.E.E. last week by Dr. G. A. V. SOWTER, consisted of the development and practical difficulties associated with high permeability magnetic alloys.

He began by giving a short historical introduction to the subject showing that the first great impetus was given to these alloys by the necessity for producing metals for the continuous loading of submarine cables. The metals developed resulted in the Permalloy and Mumetal groups.

Dr. Sowter

Nickel Iron Alloys

Industrially the basic compositions of Ni/Fe alloys which were in use, fell into three rough groups: 78% Ni/22% Fe; 50% Ni/50% Fe; and 36% Ni/64% Fe. The first of these had high permeability, the second high saturation induction, and the third high resistivity. The introduction of small quantities of other elements such as chromium, copper, molybdenum, manganese, silicon, etc., had the effect of raising the resistivity of the alloys, reducing the electrical losses, and greatly improving the time-stability characteristics.

One of the difficulties was the inclusion of unwanted impurities which affect the working. When absolute purity was approached, phenomenal permeabilities could be realised. Heat treatment was of critical importance, particularly in anisotropic alloys where the grain structure had been orientated by cold rolling.

Effects of cold working could alter the properties to a great extent, and when perfect grain orientation was attained, followed by annealing in a magnetic field very good properties could result. An interesting alloy was Supermalloy which had been made, on a laboratory scale, with maximum permeabilities of about 10^6, the saturation induction being about 8,000 gauss.

Finally, the Chairman gave some details of silicon iron alloys, and concluded by indicating the fields of application of the Ni/Fe types.

LOCAL CENTRES

A Summary of I.E.E. Chairmen's Addresses

TRADITIONALLY, chairmen of the various divisions of the I.E.E. deal with their particular interests in engineering when they deliver their inaugral addresses. In this way there is presented every year, by local centre chairmen, a valuable review of the current practice and outstanding problems in most branches of the art. This year, for instance, MR. J. ECCLES, C.B.E., B.SC. (M. and N.W. Centre) drew from his experience in the supply industry to speak on "Organisation and Management."

Large Organisations

He took the point that large corporations have come to stay as a feature of business organisation, that an increased proportion of those engaged in management will be employed in the control of these units, and that professional engineers who wish to play their proper part in the formation and direction of policy should recognise the importance to themselves of this trend towards big units. Management he analysed as operating in three closely related sections—overall, operational and functional.

Overall control is exercised by a centralised body of people, who plan policy and accept ultimate responsibility for results, and there are many forms of such Boards. The overall control of the Central Board is translated into action by functional and operational management, the first being a centralised and the second a decentralised service. Operational management is defined as the control of that part of the business which is directly responsible for the production and distribution of the business's product or service. The purpose of functional management, on the other hand, is to bring the most appropriate techniques into use, and to introduce new ideas or improved techniques when need or opportunity arises.

Harmonious relationship between high-level staffs in the two divisions are essential to successful working, and it is helpful if the functional specialists have had extensive operational experience. "High efficiency" throughout an organisation implies not only low costs, but quality that is high by competitive standards, and also a contented staff. Staffs should be "kept in the picture," but they should realise that the provison of this and other facilities cost money, and can only be maintained by the economic success of the business as a whole.

Large-scale business is a great adventure in human relationships, and in the world's present economic conditions the effort required to achieve success will tax the energy and wisdom of all parties to the enterprise.

Supply Design

More on the technical side was the Scottish Centre address, delivered by MR. J. HENDERSON, M.C., B.SC. Entitled "The Principles of Planning and Development on Modern Electrical Supply Systems," it reviewed its subject in some detail, beginning with the position in the first 20 years of the century, and covering the adoption of a.c. rather than d.c. distribution and the standardisation of frequency. With the assumption that in future all transmission over moderate distances and distribution at high and medium voltage, will be by means of 50 c/s, a.c., Mr. Henderson goes on to consider optimum voltages.

In this country 132 kV seems likely to continue as the standard Grid voltage, and 415/240 V has been fixed for distribution. However, as 132 kV gear is so expensive, and as voltage regulation considerations make it impossible to extend 415 V for more than a few hundred yards, at least two intermediate voltages are required. In the lower voltage range the standard adopted should enable the supply to be given direct to the consumers' premises even in the case of relatively small loads, and 11 kV meets this requirement. At this voltage the transmission radius for 0·9 p.f. and 10% voltage drop is about 4 miles. 33 kV has much to recommend it as the fourth voltage standard, with a 10-mile radius under comparable conditions.

With the voltages fixed, the paper goes on to compare the 11 kV and 33 kV alternatives for a 10-mile route with 11 kV nominal at each end in one case, and 11 kV at the receiving end and 33 kV at the sending, in the other.

The studies confirm the distribution radii given above, with the proviso that they apply when the load density does not exceed 300 kW/sq mile. The supply density limits the load to be distributed from any one point, but a more potent factor from the cost point of view is the rupturing duty required of switchgear. It is suggested that 250 MVA should be adopted as standard for 11 kV substations, except in

exceptional purposes. This will allow two 20 MVA transformers in parallel provided the fault potential on the 33 kV side does not exceed 750 MVA, which again allows two 90 MVA transformers feeding in parallel from the 132 kV system.

Considerable economy can be effected by switching at 132 kV, and a transmission network is considered on the basis of supplies taken at 33 kV from the Grid, with main substations of between 15 MVA and 90 MVA capacity spaced not more than 20 miles apart. Each Grid feeding point will be the centre of a 33 kV local transmission network, giving supplies at 11 kV. 11 kV networks can be paralleled to give standby capacity in emergency, and with such suitable interconnection, a firm capacity of 75% of the total transformer capacity of each substation can be obtained without endangering supply.

The paper ends with consideration of the low voltage network design, which if correctly carried out can do away with the necessity for taps on distribution transformers.

Ultimate transformer capacity of 1,000 kVA for each substation is envisaged, and the cost of supply per house is likely to be at least £40. At this level, some initial contribution towards the cost is required from the consumer.

Telecommunications

MR. R. E. SOPER, B.SC. (Southern Centre) and MR. W. F. SMITH, B.SC., A.C.G.I. (North Midland Centre) both spoke on the development of telecommunications. Mr. Smith took the wider view, and introduced his paper with a review of the statistics of telephone traffic, remarking in passing, on the remarkable way in which the mood of people is reflected in the demand they make upon the telephone system. He passed on to a survey of the history of exchange development, from the early magneto systems to the c.b.s. with automatic switching. Cables came next, with the early trunk-route copper overhead lines, weighing more than ¾ ton/mile, giving way to the loaded cables with amplifier repeaters at 40 to 50 mile spacings which are common today, and to carrier and coaxial techniques. Voice frequency signalling and submarine cables were also dealt with in this interesting address.

Cable Development

Mr. Soper confined his paper more particularly to the telecommunication circuit, starting, like Mr. Smith, with the 600 lb/mile cables. He then traced the effect of Heaviside's transmission theory and of paper insulated cables on telecommunication technique, and the subsequent practical effects of Pupin loading. Dealing with cut off, he stated that for clear speech it is necessary to transmit all frequencies between 300 c/s and 2,400 c/s, though by international agreement it has recently been decided to increase the top frequency to 3,400 c/s. Present-day loading coils, using powder cores, fulfil all requirements in ⅛ the volume of the 1925 models.

The second part of the address dealt in some detail with circuit development, the overcoming of interference troubles, and the use of carrier systems. Looking to the future, Mr. Soper predicted that coaxial cables would carry at least 960 channels eventually, and that multi-channel radio-telephony would be developed over line-of-sight routes. Wave guide systems might be developed, with a 5 in. diameter guide employing a 300,00 Mc/s carrier, and providing several thousand channels, with amplifiers spaced 80 miles apart.

Manchester History

With the half-centenary of the North Western Centre celebrated this year, MR. H. G. BELL, M.SC.TECH., fittingly chose to present a review of electrical engineering in the north-west at the turn of the century. He began with a description of Manchester and its buildings at that time, and went on to deal with the development of the Corporation's public supply system which by 1900 had become the largest in the provinces, with a demand of nearly 6,000 kW. The original station contained 1,320 kW of steam-operated plant, working on a 5-wire d.c. system, and bare copper strip, laid on edge was the form of distributing main adopted.

By 1900 there were 3,228 consumers on the Manchester system, with their load factor only 14%. Public supplies were available in a number of neighbouring towns at various frequencies and voltages.

During this period the electrical plant manufacturing industry for which the area is famous was developing. W. T. Glover's, cotton processers and braiders, became interested in cable-making, and Mather and Platt, Ltd., textile machinery manufacturers, began building electric motors. Many firms followed them, amongst them being that of Mr. Ferranti (a Liverpool man), who moved his works from London.

Technical education was in its infancy, and it received an impetus from the commencement of the first electro-technical laboratory at Manchester University in 1897, as a memorial to Dr. John Hopkinson.

Cables from the North

New Henley factory at Birtley, Co. Durham, increases production of v.r.i. and similar cables

EXTENSIVE war-time damage to the works at Woolwich caused W. T. Henley's to move part of their rubber cable manufacture to the north-east coast. This firm has not been content merely to move, however, they have taken the opportunity of building in the uncrowded space of Co. Durham a model factory embodying the experience of all their long history of cable-making combined with the most recent ideas on production methods.

The site they have chosen occupies some 45 acres at Birtley, six miles south of Newcastle-on-Tyne, and is well placed for transport facilities, with the main Durham-Newcastle road for its 1,300 ft. frontage, and the main east coast railway behind. Apart from administrative and welfare blocks and a boiler house, single-storey construction is employed for the floor area of about 400,000 square feet, which is under a single roof.

Production

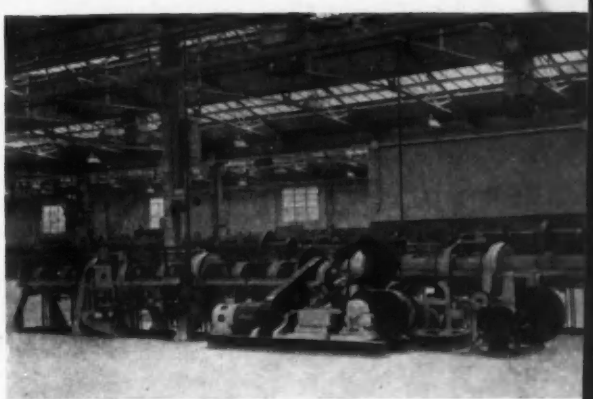
At present the factory is only partly occupied and its whole layout is designed to ease future expansion. There is a wire-drawing plant with associated tinning equipment, and some most interesting examples of high-speed stranding and bunching machines. For the rubber side of the processes, large Banbury mixers are installed, feeding heavy duty mills. From these the rubber sheet is taken to three bowl calenders from which it emerges as a thin sheet which is formed into a roll with cloth between the layers to prevent adhesion. To ensure technical consistency of the dielectric, the ingredients of the rubber mix are carefully weighed into trays which come to the Banbury operator along a roller conveyor.

Cable-making proper starts when both conductor and dielectric are ready. At the Birtley factory various forms of rubber covering are employed, the most interesting being the extrusion process. The normal method of vulcanisation for cores made in this way is for the cable to be coiled down into large trays filled with French chalk, which are then lowered into steam-heated ovens. A more modern method of continuous vulcanisation is also practised, with the covered wire coming directly from the extrusion machine into a very long steam-heated tube, from which it emerges vulcanised and ready for reeling.

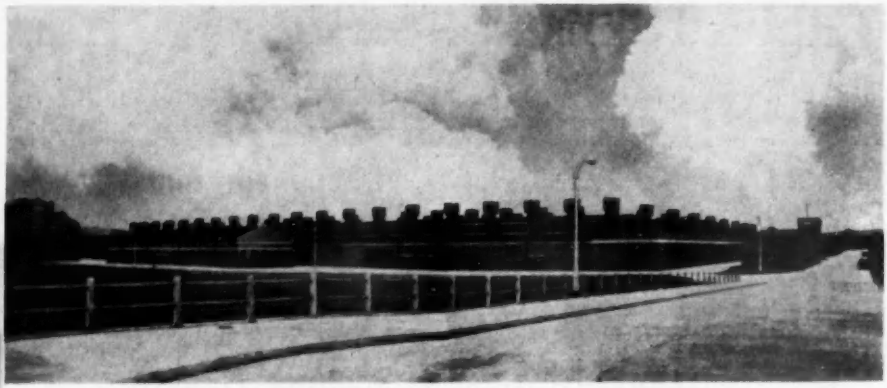
Cores covered by processes other than extrusion are wound on steel reels, placed on trolleys and passed through large circular ovens for vulcanisation. Whatever methods are used, vulcanisation is followed by such processes as braiding or lead covering.

Power Supplies

Electrical power is used for most motor drives in the factory, but heating and process steam is obtained from three 300 lb/sq in. water tube boilers installed in a separate boiler house. The electricity supply is taken at 20 kV from the N.E.E.B., with the intake point at a special substation which also serves an adjoining factory. Three 300 amp Reyrolle circuit-breakers control the three 0·04 sq in. 3-core 20 kV cables which serve three works substations. All cables in the works are naturally of Henley manufacture. Each works substation has a 1,500 kVA 20 kV/440 V Parsons transformer, and for the sake of distribution economy is located as near as is possible to the main load centres of the works.



A gallery of high speed stranding machines in the new factory



This side view of the factory shows clearly the ventilating fans

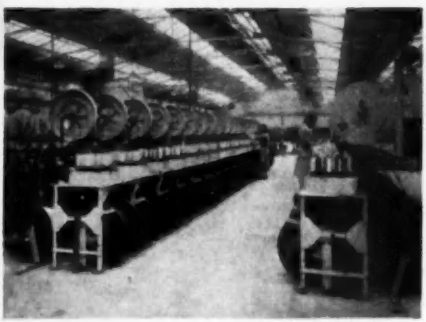
Each transformer is housed in an enclosed, ventilated compartment on the factory floor, with a low voltage switch room placed adjacent.

Three 0·75 sq. in. v.c.l.c. cables connect each transformer secondary phase to the l.t. busbars in the switch-room. English Electric air-break gear is used to control six outgoing circuits, and in addition there is a metering panel and an interconnector unit which can be used to link the busbars with the l.t. sides of the other sub-stations should emergency operating conditions make this desirable. Overload and earth leakage protection is provided on each unit.

One final substation feature of special interest is the earthing arrangement. The transformer star points have been taken to a common earth site at the south side of the factory, and are there connected to the 9 ft. c.i. earth rods.

An agreeably neat and efficient low voltage distribution system is obtained by extensive use of overhead trunking. The substation feeders are p.i.l.c. cables laid in ducts, and terminating at the busbars of standard Henley distribution pillars. Rubber insulated cables are then run in 3 in. and 4 in. metal trunking suspended on the building framework, dropping down as is requisite to large section boards supported on the building uprights, and to individual machine drives. The easy access and flexibility which a trunking system provides is specially valuable with a condition of expanding plant. Henley h.r.c. fuses are used extensively for medium voltage protection of the various circuits, which include motors of up to 200 h.p. (used on the heavy mixing mills).

Braiding machines operating in the new factory



Lighting circuits are kept separate from the power runs, and independent distribution boards are provided. The general aim is to provide an illumination of 20 lumens at work level, and to obtain good colour rendering B.T.H. blended units are installed. These consist of a 400 W mercury vapour lamp and a 500 W tungsten filament bulb combined in one reflector. Combined with the close attention given to wall and machinery paint, the use of these lamps produces a very comfortable working atmosphere.

Ventilation and heating are combined in the factory by the use of unit heaters which use steam as a heat source. The fans in the heaters circulate the air either heated or unheated, and can also draw it in from outside, if this is desired. Stale air is extracted by natural draught through 180 Robertson type ventilators, whose cylindrical shapes give the factory a characteristic appearance when it is approached. They can deal with eight complete changes of air per hour.

On Monday the full status of this new unit of the Henley organisation was marked by an official opening ceremony performed by the Lord Lieutenant of the County of Durham, the Rt. Hon. Lord Lawson of Beamish, D.C.L.

Notes on Wiring
by MEGOHM

New Site Work

Some Suggestions for Improving Conditions

AS our so-called summer recedes into the past, and winter is almost upon us once more, it may not be inopportune to spare a thought for those unfortunate operatives on new sites, who are charged with the task of translating designs into practical reality.

It is one thing to sit in a well-furnished, well-heated office and decide what is to be done, but quite another matter to carry out the work speedily and efficiently in the dark, cold, dirty and overcrowded conditions, normally found in any large new building during the early stages of erection.

Much has been done from the safety point of view since the Building (Safety, Health and Welfare) Regulations, 1948, came into force just over two years ago, but it is not possible, in the nature of things, to have the same standards of comfort on a building site as one can provide, say, in a completed factory building. We could, however, go some way towards this ideal.

Poor Working Conditions

Normal practice, as soon as the carcase of the building is up, is to put on the roof, and gradually work downwards. With the common flat-roofed design, this means that the tubing to the top floor lighting points must of necessity be laid in the open, and the wireman is inevitably exposed to the vagaries of the elements during the process. This cannot very well be avoided. But once the roof is on, I think we could improve on our present methods, by making conditions more tolerable than at present.

I recently had occasion to visit a seven-storey building in course of construction, where the brickwork was almost completed, but no doors or windows had been fitted. A keen east wind was blowing and the conditions were most uncomfortable. For lack of other suitable storage accommodation, and due to the restricted site, the dark and damp basement was crammed out with the material pertaining to the various trades; a veritable dust storm transformed the ground floor into a miniature Sahara; sulphur-laden smoke from the plumber's forge made the first floor almost untenable, and acrid fumes from some overheated bitumastic compound made the next floor similarly unattractive for speedy and efficient workmanship.

Admittedly, this is a bad case and I happened to visit the site on a bad day; but I am quite sure that the output per man hour was much below the average one might expect.

Suggested Remedies

The first step to improve matters, I would suggest, is to ensure that adequate storage facilities are provided for the necessary materials, and, equally important, that materials should not be sent to the site before they are required. This will give more room for all concerned and avoid a certain amount of loss and damage.

During adverse weather conditions, a fair amount of screening could be provided in the form of transparent shuttering for the window openings, if the permanent glazing cannot be done for structural reasons. Any form of shelter is better than none and natural daylight is, after all, the best form of illumination.

The lighting of the site is usually far below the standard one should aim at, and accounts for much delay in the progress of the work. If it is possible to introduce what virtually amounts to floodlighting at the coal-face in mines, it should not be impossible to provide proper lighting on a new building in course of erection and cut out some of those "wandering leads" which never seem to be where most wanted.

To complete our improved working conditions, and therefore output and all-round contentment, it should not be impossible to provide a modicum of heat sufficient for our comfort, yet not enough to hasten the drying out process to a point unacceptable to the architect.

There are on the market various types of hot-air circulators of the convector or fan type which would seem ideal for the purpose, and which, I think, would in the long run repay the cost involved. The latter type, in fact, would help to clear the dust or fume-laden air. Perhaps some farsighted architect might be induced to give the foregoing matters a trial on some suitable site. I am fairly confident that the overall results would be better, both from the point of view of workmanship and speedier completion of the building.

Using Electricity Efficiently

I.E.E. UTILISATION SECTION CHAIRMAN'S ADDRESS

THE question of the most efficient use of electricity industrially formed the subject of MR. A. N. IRENS' Chairman's Address delivered at the I.E.E. last Thursday. He pointed out the difficulty of obtaining a rigid definition of efficiency in this connection, but taking it in a very broad and simple sense, it could be regarded as the achievement of the maximum benefit from the minimum effort. There used to be a good rough and ready yardstick in the respective costs involved, but in these days of taxation, subsidies, and arbitrary price controls this was no longer generally applicable. For example, with the present price structure it was cheaper to use the best quality coal instead of the inferior grades which power station boilers were designed to burn.

Mr. A. N. Irens

However, on the question of efficiency of utilisation there were one or two promising fields available. First, the parallel operation of private plant could be encouraged. Most of the traditional objections to this had now been overcome, and the loss in revenue to the public supply was swamped by the national interest and the need for conserving fuel. Modern protective equipment could overcome many of the difficulties of running a small unit in parallel with a large system.

Control of factory loads could make a valuable contribution to the efficient use of the limited generating capacity available, and by judiciously varied tariffs, it should be possible to encourage industry to take a heavy summer load when generating plant was running light. Much could also be done in the reduction of maximum demand, by cutting off low priority loads, at times of heavy loading to retain the demand within a certain stipulated figure.

Lighting

In many industries lighting was the predominant load, and frequently the load factor for lighting was very bad. Many factories still possessed lighting systems which had been designed and installed when the price of electricity to industry was much cheaper than at present. Fluorescent twin-tube fittings could contribute greatly to economy and to increased production, but here again economic difficulties arose due to the fact that capital spent by industry was treated by the taxation authorities in quite a different way from capital spent by the supply authority and paid for by the consumer as a revenue item.

It was also to be hoped that efforts would be made to overtake the lee-way in street lighting which has occurred during the last ten years. It was not easy to make out a case for better street lighting in terms of hard cash, for life could scarcely be valued in terms of money.

Heating

Except in electrochemical processes, the whole of the power taken by a factory was in fact transformed into heat, and could be usefully employed in winter in helping to maintain a comfortable working temperature. In summer, however, this slight gain was counterbalanced by the load of plant required to get rid of the heat. Because electric heating was so easily controlled and so flexible and could be applied in so many ways, the economy of utilisation was often overlooked and insufficient attention paid to thermal insulation.

During the war years there was a tendency to order motors by rule of thumb, and this habit may have carried over to some extent into the post-war period. Full attention should be paid to the economics of each case, and each drive considered separately. Full advantage should also be taken of recent advances in design in relation to duty cycles, special torque conditions and speed controls. Supply engineers should examine their local regulations with regard to motors with a view to providing some relaxation with benefits all round.

On the domestic side, the main need was for better heat insulation, particularly where water heating systems were concerned. Properly applied, domestic water heating was fundamentally sound.

Finally, Mr. Irens referred to the necessity for consumer's engineers to help the small factory which did not employ a qualified electrical engineer, and also he considered that there was a good deal of scope for consulting engineers to be retained by industrial concerns, not only for initial capital construction and installation, but also to advise, in many circumstances, on day-to-day problems.

Problems and Practice

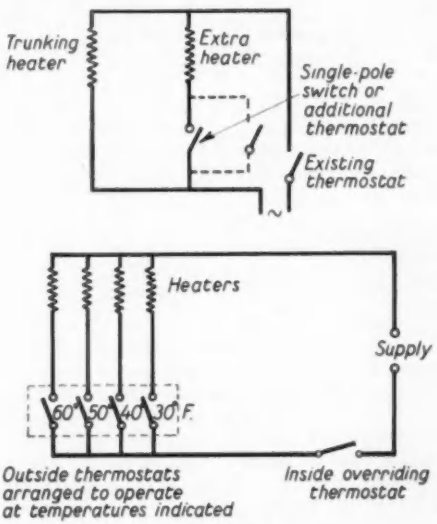
IN ENGINEERING

Restricted Thermostat Control

I HAVE noticed with interest the diagram under "Restricted Thermostat Control" in July 20 issue, and I believe this diagram can be simplified as shown in the sketch.

Taking this a step further, an additional thermostat could be inserted in place of the switch as shown by the dotted lines. This thermostat should be set at a slightly lower setting than the main thermostat which will ensure that the auxiliary heaters will not come on except when the main heaters are not sufficient to maintain the desired inside temperature.

Alternatively the thermostat could be connected as shown, but fitted outside the building and set to operate at an outside temperature for which is normally considered necessary to employ the auxiliary heaters. This setting is not very critical because even if the heaters come on before they are really needed, the desired temperature would be maintained by the inside thermostat.



[Thermostat control connections

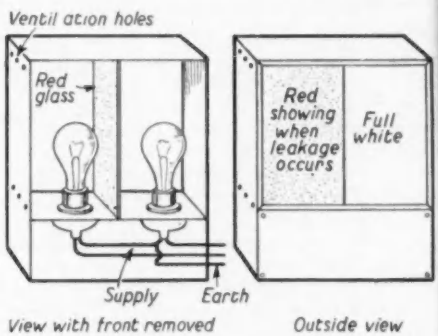
This arrangement has interesting possibilities because it is possible to arrange any number of outside thermostats which can be set at different levels and arranged to bring in various heaters, as shown.

When electric heating is used and closed control is required, this method is very desirable because one inside thermostat controlling a heavy-rating heater is bound to cause overshooting and undershooting of temperature with resulting considerable variations from the control point.

Usually, of course, the ratings of the heaters are such that the inside thermostat has to be used in conjunction with a contactor.—*Alf Homega.*

Leakage Indicator

AN indicator which I thought of many years ago, although simple, has been very effective in the works where I am in charge.



Details of earth leakage indicator

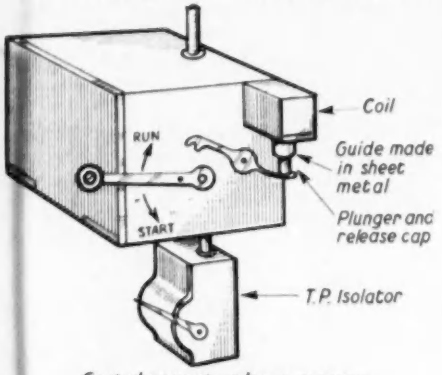
There are many types of leakage indicators, bells ringing, meters, etc., but my idea is just the lamps in series to earth where one lights up full voltage, and the other goes out when a leakage occurs, thus the light deflects a red ray on half the opal front glass, the other half lighting up full white.

This leakage indicator burns during working hours of the d.c. cranes, and, I might add, through prompt action on receiving word of a leakage, I have prevented many a serious breakdown.—*G. A. Leighton.*

S.D. Starter Trouble

I WISH to support J.P.'s article in "Problems and Practice" of August 17, 1950, regarding the inadvisability of having work done by amateurs. The following is another incident which led to a great deal of trouble and delay.

It was reported that a 7·5 h.p. star/delta 3-phase motor periodically failed to start, and every time this occurred one or two of the isolator fuses were blown. On being called to inspect the job the usual routine inspection was carried out and everything appeared

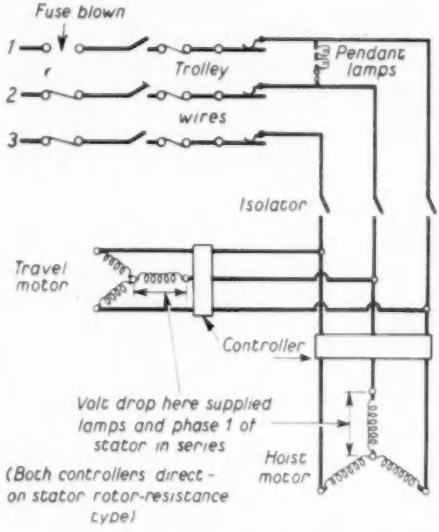


Control gear upset by an amateur

normal. Further, a Megger test on the motor and s.d. starter gave very satisfactory readings; thus the motor was started up, and in throwing the starting handle over to the running position it was noticed that the release plunger instead of lifting sharply into the solenoid just crept up slowly; a number of starts gave the same results. A weak field was suspected; however, on test the 400 V solenoid coil was found okay. Closer inspection of the solenoid revealed that at one time the guide for the plunger, which incidentally in this starter was made of Bakelite, had been broken—a handyman soon fixed that up and a very neat job it was. A guide was made of sheet metal; this, of course, screened the field, resulting in a very weak lift on the plunger, hence the creeping-up effect. At times, when the plunger failed to lift, the one starting the motor forced the release catch into the on position; this held in position due to the spring tension on the starting handle. As the plunger was already resting on the release catch, the starter did not trip when the supply was switched off at the isolator. Forgetting this when a fresh start was made, immediately the isolator was switched on, pop went the fuses. However, a brass guide was made and no further trouble was experienced.—*C. Williams.*

Novel Lighting and Power System

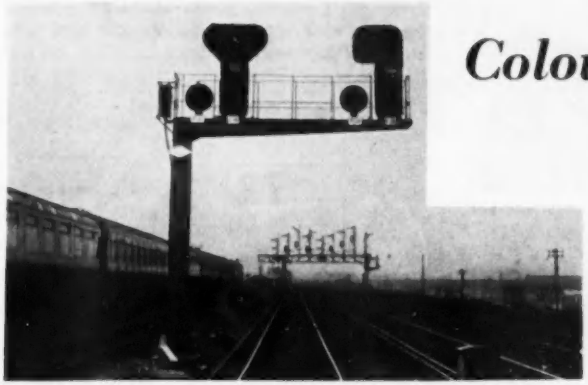
OPERATION of travel and hoist controllers on a faulty 3-phase travelling crane indicated probable single-phasing on both machines; also two pendant lamps under the gantry, normally alight when trolley wires are alive, glowed half bright only when the motors were switched on. The operator reported all fuses intact. Tests at the trolley wires showed normal voltage between phases 2-3 and 1-3 only, but all phases alive to earth! Further investigation produced the diagram shown and another set of fuses, hitherto unheard of, one of which was blown, i.e. in phase 1. The blown fuse in phase 1 and the connection of the lamps across trolleys 1-2 explained the situation, since the lamps made phase 1 alive



Circuit for power and lighting supply

to earth but dead to phase 2, and also lamps lit up due to half-phase voltage across one phase of either motor. The cause of the blown fuse was overloading of the hoist motor due to brake trouble and the fuse itself being wired lighter than its fellows. The brake and fuse were put in order and everyone was happy again.—*J. R. Butler.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.



Colour Light Signalling

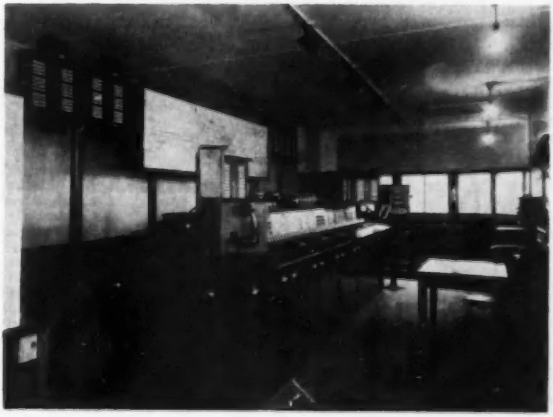
Progress in conversion of British Railways Southern Region central section

IN 1946 it was decided that the existing Sykes Lock and Block mechanical signalling system in the areas Battersea Park—Coulsdon North and Bricklayers Arms Junction—Croydon should be replaced by colour light signalling. The completion of this work would thus make available continuous colour light signalling from Victoria to Brighton and London Bridge to Brighton. At present, however, only the first stage has been finished, the total job being divided into four stages and spread over six years. Stage 1 runs from the Bricklayers Arms to Norwood Junction; Stage 2, from Battersea Park to Selhurst, will be completed in 1952; Stage 3, Norwood Junction to Gloucester Road Junction, in 1954; and Stage 4, from East Croydon to Coulsdon North, in 1955.

Although from the map the actual distances between these points are small, in fact the scheme as a whole involves 98 track miles, with continuous track circuiting, and is estimated to cost £1,750,000.

Stage One

The first part of the scheme was completed and came into operation on the night of October 7/8. Eight signal boxes were replaced by three new all-electric boxes, totalling 147 working levers (instead of 279), and controlling 7 route miles or 28 track miles. The new boxes, at Bricklayers Arms (55 levers), New Cross Gate (71 levers), and Forest Hill (47 levers), include maintenance staff accommodation, relay rooms, accumulator rooms, stores and working accommodation. The signals themselves consist of ninety-six 4, 3, 2, and single-aspect, main and subsidiary colour-light signals of the multi-aspect long-range type, the castings of which are in aluminium alloy. Signal lamps of the 12 volt 25 watt double filament type are used, the distribution voltage of 110 being stepped down by transformers housed in the signal casting. Apart from the signals themselves, there are seven multiple-lamp route indicators and 13 junction indicators, which are mounted on top of their respective signals without additional support. The spacing is arranged to provide for a 2½ min. headway for following stopping trains. Shunting signals are of the disc type, solenoid operated, and may be floodlit as necessary.



Interior of New Cross Gate Signal Box. Note signalman's telephone panel and train-describer transmitter at each end of frame and train-describer receiver alongside the illuminated diagram

Above: Bricklayers Arms Junction new signal box. Existing signal box is to be abolished. Right: A diagram showing scheme of work

Points are operated by 76 electrical point machines, most of the power being supplied by 120 V accumulator batteries, located in the signal boxes. Where the points are less than 500 yards from the box direct switching is employed; over this distance, a contactor relay is used and power taken to the machine from a local rectifier unit.

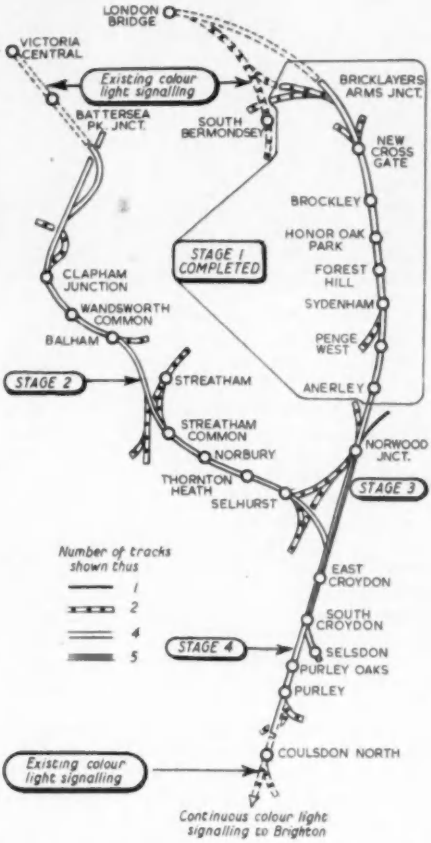
Power Supplies

The main power supply is distributed by a 3·3 kV 50 c/s three-phase system, which, when completed, will form a ring main following the railway route between Waterloo and Croydon via Forest Hill and via Streatham. The first section between Waterloo and Croydon via Forest Hill has been completed and is in operation. Connection to the London Electricity Board's 11 kV network is made at Waterloo where the voltage is stepped down to 3·3 kV and where the whole of the supervisory control for the 3·3 kV system is located. At the signal boxes, the voltage is again transformed to 480/240 volt single phase for local use. A 3·3 kV 3-phase supply is also available in emergency from the railway's traction sub-station at South Croydon.

The cable used is of the three-core 3·3 kV p.i.l.c. armoured type with 0·2 sq. in. cross sectional area. With the power cable is also laid a 12-core composite pilot cable of which four cores are used in connection with a Translay system of feeder protection, the remainder being utilised for supervisory control.

At the signal boxes, two transformers are provided, one as standby, the ratings being standardised at 30 or 50 kVA as required.

The operating levers in the boxes are of the miniature type with all-electric interlocks, and behind each signal lever is repeated in miniature lights all aspects of the signal it controls. Normal and reverse track locks are fitted to each point lever. Behind the lever frame is a large illuminated diagram of the area controlled showing all signals, points and track circuits together with their indication numbers and letters. Train positions are also shown on the diagram.



The whole installation was designed and carried out by the Signal and Telecommunication Engineer's Department, the 3·3 kV system being the responsibility of the Mechanical and Electrical Engineer.

PRINCIPAL CONTRACTORS

Asea Electric: 3·3 kV equipment.
Chamberlain and Hookham: Metering equipment.
General Electric Co.: 3·3 kV and 480 V switchgear.
Metropolitan-Vickers: 11 kV switchgear and Translay Protection.
Pirelli-General: 3·3 kV cables.
Pritchett and Gold, E.P.S. Co.: Batteries.
Standard Telephones and Cables: Battery Charging equipment.
Salford Instruments: Measuring instruments.
Westinghouse Brake and Signal Co. and Siemens and General Electric Railway Signal Co.: Signalling apparatus.
B.I. Callender's, G.E.C., Glover and Co., W. T. Henley's, Johnson and Phillips, Siemens Bros.: Cables.

"A POINT OF VIEW"

The A.S.E.E. President pleads for a broader outlook on the engineer's attitude to life

INAUGURATED as President of the Association of Supervising Electrical Engineers on Tuesday night, MR. T. G. N. HALDANE, M.A., M.Inst.C.E., M.I.E.E., commenced his Address by paying tribute to his predecessor, MR. A. G. RAMSEY, C.B.E., B.SC. (ENG.), M.I.E.E., and the effort he had devoted to furthering the interests of the Association. He then drew the attention of his audience to the work which the I.E.E. had been doing in the field of education and training, notably the Joint Committee Report on education and training of technicians.

Mr. T. G. N. Haldane

The respective functions of the professional engineer and the technician were closely connected, said Mr. Haldane, although there were differences in the degree of responsibility usually carried.

In the past, the need of industry for a large and well-trained body of technicians, and the special requirements in their training, had tended to be overlooked, and training had been haphazard—the Ordinary National Certificate, for example, being not wholly suitable. He was sure that members would be pleased that such careful thought was being given to suitable training. Technicians outnumbered professional engineers by five to one, and it was necessary to consider whether existing associations covered their needs. In this respect, the A.S.E.E., containing as it did both professional engineers and technicians, was able to promote collaboration between the two.

Status and Happiness

All, whether professional engineers or technicians, had much in common. None of us, he said, were engineers only, and our value to the community depended not only upon our vocational duties, but on the sort of thoughts we thought and the sort of lives we led which, in turn, was governed by our general outlook—the ideas we attended to, and those we pushed into the background. Although his status had always been of considerable concern to the engineer, status, like happiness, was an elusive quality which might elude the grasp if pursued too directly. If we took a proper point of view in life, and sought, for their own sake, things of permanent value, it was very likely that status and happiness might be achieved.

The Broader View

With the enormous amount of specialised knowledge which the engineer had to acquire, it was becoming increasingly difficult to preserve the broad viewpoint from which science could be seen in its proper relationship to other major branches of knowledge, such as philosophy, art and religion. Engineering, or the practical application of scientific knowledge, was a means to an end, and not an end in itself. In our efforts to improve industrial efficiency, we should never forget the fundamental things which made life worth living. Reviewing the history of science, the President pointed out that progress had been limited more by mental rather than by technical difficulties—the progress had been an evolution of thought far more than one of technique, and he instanced the milestones in the history of scientific thought marking the surmounting of the intellectual difficulties which impeded the advance of knowledge.

We were now in process of surmounting another intellectual barrier—the great change in scientific outlook which has occurred during the first half of the present century, which was comparable with that which occurred in the seventeenth century. Up to the second decade our conception of the universe was dominated by classical physics, and the period we had been going through in recent times was one of much confusion, which was still far from being cleared up. We had a largely symbolic and mathematical world for which we could find no mechanical model, a world in which energy and matter were interchangeable, and in which there was no absolute space, time, or motion, and it was increasingly difficult to accept the shadowy mathematical universe of science as an adequate description of reality.

While far from disparaging science, he emphasised once more that none were engineers or scientists only, and it was important that we should be aware of the limitations of our vocation as well as its possibilities. Such awareness would add to our reputation and status in society and help to provide a true scale of values.

"We, as engineers," he said, "are bringing to the human race the conditions which make a full and better life possible, but do not let us for one moment suppose that our power stations, our transmission lines, our factories, our telephones, our electric lighting, our wireless, our motor cars, and all the rest, have value in themselves except as a means to that end. I am afraid that confusion of thought on this matter has made us lose sight of spiritual values and of the true purpose of life."

overseas news

Iceland's Expansion

An expansion programme, to nearly double the nation's electricity supply, has been launched by the Government of Iceland. At the present time, the power supply in Reykjavik is being overtaxed, due to the increasing use of electric cooking apparatus. Orders have now been placed with the Westinghouse Electric International Co. for hydro-electric generating equipment to serve the country's two main population centres, Reykjavik, the capital, and Akursyri, the textile centre. Two 21,000 h.p. turbo-generators and auxiliary equipment are to be installed at a new station at Ira Falls, on the Sop Rij, about 32 miles from Reykjavik. Natural penstocks are cut in lava rock for the other scheme, to be known as the Laxavirkjan project, an 11,500 h.p. station is to be established near the Bruar Falls. All these machines are to be delivered by the end of 1951.

The Story from Brisbane

There was no evidence that the recent average rate of increase in unit sales—20% p.a.—had reached saturation point, declared the chairman of Brisbane City Council Electricity Committee, Ald. Roberts, recently. There had been a tremendous increase in the use of electrical appliances since 1945. It was in the interests of economy in the industry and of the consumers that wastage of power should be avoided. Figures presented to the committee showed that while only 4,461 electric water heaters were connected to the council's service in 1945, the number today was 23,006. The number of electric cookers had risen from 4,761 to 13,544, and electric motors from 6,963 to 12,075. Total number of units sold in 1945 was 112.9 million, while the estimate for 1950 was 199.2 million. The council had 68,850 consumers in 1945 compared with 86,925 now. Street lights had also increased from 8,022 to 9,176.

Further Plant for Victoria

Two 30,000 kW, 3,000 r.p.m. back-pressure turbo-generator sets have just been ordered from the Metropolitan-Vickers Electrical Co. Ltd., by the State Electricity Commission of Victoria, for the new power station at Morwell, in the Yallourn open-cast coal-mining area. These sets, and three similar machines already under construction at Trafford Park, will feed the Commission's 11 kV network, and the exhaust steam from the turbines will be used for drying crushed coal for briquette-making. The turbines will be single-cylinder machines working with inlet steam conditions of 1,200 p.s.i.g., 915° F. and exhausting at 28 p.s.i.g. with about 20° F. of superheat; each will have a velocity-compounded stage followed by 15 single impulse stages. The turbines will be supplied with two-stage "super high pressure" feed heating equipment to raise the temperature to 380° F., the feed heaters working at 1,800 p.s.i.g. The turbo-generators, rated at 33,333 kVA, will be wound for 11 kV and will be air-cooled with closed-circuit ventilation.

It was also announced last week-end that the Commission had placed orders for plant for the Kiewa No. 5 hydro-electric station, valued at £234,000. Two 16,000 kW generators are to be supplied by Metropolitan-Vickers, and the associated water turbines by Boving and Co. Ltd.

Boilers for Osborne

At its meeting earlier this month, the Electricity Trust of South Australia approved the placing of a contract with Babcock and Wilcox (Aust.) Ltd. for four boilers for the Osborne "B" power station.

Contracting in Quebec

Between 700 and 800 master electricians in the State attended the first general convention of the newly formed Corporation of Master Electricians of the Province of Quebec, held at Montreal earlier this month. Under a Provincial Act which takes effect from November 29, no master electrician in the province will be allowed to carry on his trade unless he is a member of the Corporation. It was announced that of the 2,500 electrical contractors operating in the province over 1,100 had already joined. One of the first items on the agenda at the convention was the approval of by-laws regulating professional standards.

N. Quebec Development

The 34,500 h.p. extension to the Quinze River power development of the Northern Quebec Power Co. is expected to be in operation by the end of this year. It had been hoped that the plant would be ready by summer, but slight delays have hindered progress. Plant capacity of the company at the present time is 50,000 h.p.

Diesel-Electric Locos

Canadian National Railways have just placed orders for 18 diesel-electric locomotives, valued at $2,385,000, with the Canadian Locomotive Co.; and for eight diesel-electric locos from the Montreal Locomotive Works, at a cost of about $1,500,000. The latter engines are to be of 1,600 h.p. Delivery of the new locomotives is expected to be made early next year. So far this year the C.N.R. has received delivery of 29 diesel-electric locos.

Canadian Trade

Canadian manufacturers of electrical equipment and devices for the most part in larger industrial lines rather than in consumer goods, are losing their hold in world export markets, according to a number of delegates attending the annual meeting at Niagara Falls of the Canadian Electrical Manufacturers' Association, which concluded a few days ago. It was said that higher prices of raw materials, rising wages, and sharply increased competition of American, German, and Japanese manufacturers were some of the reasons for a recent drop in Canadian exports of electrical goods. Local manufacturers were also finding competition in the home market on the increase, the tariff concessions made at Geneva in 1947, being partly blamed for this. At the conference, Mr. W. C. Cannon, president and general manager of Frigidaire Products of Canada Ltd. was elected president for the ensuing year. Which reminds us —we have been told that our paragraph in September 14 issue concerning a new factory at Scarboro for Frigidaire of Canada has been interpreted to refer to the Yorkshire town—the Scarboro in question is in Toronto, Canada.

Indian Exhibition

In connection with the first Indian International Engineering Exhibition to be held at New Delhi next January, the Government of India has decided to allow imports of exhibits of machinery and other engineering equipment to the extent of £750,000 to cover the requirements of all the participating countries. Participating companies will be allowed to sell exhibits after the exhibition, on payment of duties and taxes, if any. The exhibition, which is being held at the same time as the Fourth Congress on Large Dams and the sectional meeting of the World Power Conference, will be situated in the open space between Delhi and Turkman Gates.

Geo-Thermal Tests

In their tests during investigations into the efficacy of geo-thermal power, engineers of the D.S.I.R. of New Zealand have made seven bores in the Wairakei area from one of which steam roared 200 ft. into the air. In the test bores steam has been found at pressures of up to 90 lb. to the square inch at depths ranging from 600 ft. to 900 ft. Some of the bores have blocked quickly after "blowing," and it has been necessary to re-open them by further drilling.

Nive Scheme

Good progress is being made with the excavation of the tunnel for the Nive River power scheme, Tasmania.

The Commissioner of the Hydro-Electric Department, Mr. Knight, recently stated that the portal in the side of the hill had been completed, and work on the actual tunnel was in progress. The tunnel would be half a mile long, with a diameter of 17 ft. Water would be taken through it to pipelines serving the Tungitinah station.

Expansion in[S. Rhodesia

The latest undertaking to record an increase of over 25% in unit sales—we noted Singapore's advance last week—is the Electricity Supply Commission of Southern Rhodesia. For the year ended March 31 last, a total of 219·1 million units were sold—an increase of 26·79% over the previous twelve months. The year's operations resulted in a surplus of £46,002 which has been used to reduce the accumulated deficit. Extensions to transmission and distribution systems of all voltages totalled 725 miles. The Commission has strong feelings concerning the price it pays for coal. It recalls that before the expiration of the agreement with the Wankie Colliery Co. in September, 1948, the Commission was paying about 8s. 2d. per ton at pithead. From October, 1948, to February, 1950, the price was 10s. and from March, 1950, it had been 12s. per ton to all industrial consumers. In its own generating stations the Commission consumed 144,032 tons during the year. In addition, the Bulawayo and Salisbury municipal stations used about 35,000 tons for electricity purchased by the Commission, "yet the Wankie Colliery is in a position to charge the Commission, second only to the Rhodesia Railways in the magnitude of its consumption, the same rate as any casual purchaser of a few tons." There is no contract agreement in force, the Commission purchasing on a monthly basis.

Babcock Factory in S.A.

Babcock and Wilcox of Africa (Pty.), Ltd., an associated company of Babcock and Wilcox, Ltd., of London, is at present engaged in laying down a works for the manufacture of Babcock products at Vereeniging, near Johannesburg. A site of about 40 acres has been acquired and the factory layout is to modern design. Initially three shops are being laid down with provision for extension as demands arise. Contracts have been placed with local suppliers for the buildings, and work on the site is proceeding. Orders have been placed with British manufacturers for machinery, and much of the equipment to be installed is of a special nature necessary in the production of modern boiler plant and other B. & W. specialities.

New Edison Station

The Detroit Edison Co. has announced plans to construct a £35 million generating plant on the St. Clair River front midway between Marine City and St. Clair, Michigan. With a plant capacity of 400,000 h.p., the station is scheduled for completion by the end of 1953. It will bring the Edison Co.'s total generating capacity up to more than 2,600,000 h.p. Recent world events were given as a major reason for the decision to build the new Edison plant, instead of installing additional generating equipment in its existing plant, opposite the Sarnia Indian Reserve. Construction is to begin early in December.

PERSONALITIES
IN THE INDUSTRY

With the impending retirement of **Mr. J. T. H. Legge,** M.I.E.E., it is announced that **Mr. A. C. Thirtle,** A.M.Inst.C.E., A.M.I.E.E., M.Inst.F. has been appointed divisional controller of the South Western Division of the B.E.A. Mr. Thirtle was previously chief generation engineer (operation) with the Eastern Division. Prior to nationalisation he was city electrical engineer and manager at Carlisle, having previously been at Swansea from 1939 to 1944. There, as deputy chief engineer and manager, he was engaged on the modifications and extensions to the Tir John power station. Mr. Legge, who is shortly to retire, was chief engineer of the Shropshire, Worcestershire and Staffs Electric Power Co. from 1914 to 1925, when he became chief engineer and general manager. Four years later he was appointed managing director of the company and also of the South Wales E.P. Co.

Mr. J. T. H. Legge

Mr. A. C. Thirtle

For two years he was managing director of Edmundsons Electricity Corpn. Ltd., before joining the C.E.B. in 1935 as manager of the South West England and South Wales area.

Just arrived in this country from Adelaide is **Mr. R. H. M. Lea,** B.E., A.M.I.E.E., A.M.I.E.Aust., chief engineer and manager of the Electricity Trust of South Australia. He is expected to remain here a few weeks, checking upon the progress being made on plant ordered for the Port Augusta and Osborne "B" power stations; and will later visit America.

Mr. D. E. Webb has been elected deputy chairman of the Calcutta Tramways Co., Ltd.

The call of the industry seems to be too strong for **Mr. J. R. Struthers,** M.I.E.E., who retired from the position of manager of No. 3 sub-area of the Yorkshire Electricity Board in March, 1949. He has now returned to Northern Ireland where he had previously spent many happy years. (He was with the Belfast undertaking from 1922 to 1935, latterly as deputy city electrical engineer). This time he has accepted the appointment of sole representative for the whole of Ireland for the Mitchell Engineering group.

Mr. D. G. Armstrong, A.R.S.M., B.Sc., A.M.I.M.M., has joined the staff of the Research Laboratories of the General Electric Co. Ltd., and has been placed in charge of the mineral dressing group which operates on behalf of the Fraser and Chalmers Engineering Works.

At present district engineer for the Kirkcudbright district of the South-West Scotland Electricity Board, **Mr. D. M. Thornton,** B.Sc., A.M.I.E.E., has been selected as sub-area engineer, Southern Sub-Area, of the South-East Scotland Electricity Board.

Just appointed deputy divisional controller of the London Division, B.E.A., is **Mr. A. Pollitt,** M.I.Mech.E., M.I.Mar.E., A.M.I.E.E., previously chief generation engineer (construction) with that Division. He was for long associated with the London Power Co. after early experience in Manchester, under the late Sir Leonard Pearce, on the development of the Barton power station. When, in 1926, Sir Leonard joined the London Power Co., Mr. Pollitt accompanied him as assistant chief constructional engineer, and in 1932 succeeded to the post of chief constructional engineer, being largely responsible for the design development and commissioning of the Deptford West and Battersea stations. More recently he has been concerned with many other London stations

Mr. A. Pollitt

Deputy chief labour relations officer of the British Electricity Authority since April, 1949, **Mr. S. S. Scott,** M.A., has been nominated chief labour relations officer in succession to **Mr. A. H. Banks,** O.B.E., whose retirement we noted on September 28. Mr. Scott served with the Northmet Power Co. from 1921, initially as personal assistant to the chief engineer and afterwards as staff officer of the company. He was a member of the D.J.I.C. and the District Joint Board for the London area, also a member of the N.J.I.C. and N.J.B. On the formation of the B.E.A. in 1947 he was appointed deputy director for establishments.

Mr. S. S. Scott

At the annual general meeting of the British Valve Manufacturers' Association, the chairman, **Mr. E. Bruce Bail,** of Glenfield and Kennedy, and the vice-chairman, **Mr. J. M. Storey,** of Dewrance and Co., Ltd., were re-elected to those offices.

The South-West Scotland Electricity Board has promoted **Mr. R. J. Rennie,** B.SC., M.I.E.E., to deputy chief engineer. He will combine his new responsibilities with his previous duties as operation and maintenance engineer. Educated at the High School of Glasgow and University of Glasgow, Mr. Rennie served a vacation apprenticeship with Fraser and Borthwick, and a college apprenticeship with Metropolitan-Vickers. With the latter firm he was production engineer from 1923 till 1926, when he joined the Glasgow Corporation Electricity Department as a laboratory assistant. In 1928 he became assistant area engineer to the Clyde Valley Electrical Power Co., being promoted to area engineer in 1934, which position he held till 1939, when he joined Central London Electricity Ltd. as assistant distribution engineer. With that concern, he successively held the posts of deputy district chief engineer, district chief engineer, and, at vesting day, development engineer.

Mr. R. J. Rennie

Mr. D. M. Steel has been appointed chief technical engineer of the Renfrew works of Babcock and Wilcox, Ltd., in succession to **Mr. T. W. Pollock.**

Previously principal assistant in the chief accountant's department, **Mr. W. H. Hughes,** A.C.C.S., has been nominated deputy chief accountant to the South-West Scotland Electricity Board.

For the past four years general manager of the Electro Mechanical Manufacturing Co. Ltd., **Mr. J. Whitehead,** A.M.I.E.E., has now been nominated works director of the company. He served an apprenticeship with Erskine, Heap and Co., later joining the contracts drawing office of Crompton Parkinson Ltd. at Chelmsford, and afterwards serving in the design department of the Harland Engineering Co. Ltd. He joined the engineering department of Ferguson Pailin Ltd., in 1937, and in 1943 became chief electrical engineer for the Stone Platt Engineering Co. Ltd., of Antrim, on special Admiralty work. A short period was later spent with Platt Bros. on electrification of textile machinery, before joining his present firm.

Mr. J. Whitehead

Measurement Ltd. announce that **Mr. R. Connor,** A.M.I.E.E., director and general manager of the company's hydraulics division, has been additionally appointed general manager of the electricity meter division. **Mr. E. W. L. Cowan,** who has for the past 2½ years been in charge of the latter division, has relinquished that post to take up another appointment.

After spending some time at the Wednesbury works acquiring specialised knowledge of the company's products, **Mr. J. Arnold,** A.M.I.E.E., has now been appointed Scottish resident engineer for Wm. Sanders and Co. (Wednesbury) Ltd., and has taken up duties this week.

Formerly with the North-Western Electricity Board, **Mr. R. S. Wylie** has this month taken up duties as district commercial officer at Southampton, to the Southern Electricity Board.

Since 1946, chief estimator at head office, to George Ellison, Ltd., **Mr. J. F. Cunningham,** A.M.I.E.E., has been appointed manager of the company's Leeds and district sales office. Mr. Cunningham was educated at the De La Salle College, Sheffield, the Birmingham Technical College, Regent Street Poly and the Battersea Poly, and served an apprenticeship with Thos. W. Ward, Ltd. He joined George Ellison Ltd. in 1936, and transferred to the London and district sales office in 1938, later representing the company as sales engineer in the South London area.

Mr. J. F. Cunningham

Presentations were recently made at the Trafford Park works of Lancashire Dynamo and Crypto Ltd., to five employees who had completed 50 years' unbroken service with the company. The recipients were **Mr. J. G. Shaw,** the present vice-chairman who was a joint founder of the Crypto Electrical Co., Ltd., **Mr. G. W. Blankley,** of the London sales staff, **Mr. J. Leary,** a joiner, **Mr. T. A. Loden,** armature winder, and **Mr. A. Pollitt,** liaison engineer. Fourteen other employees were presented with gold watches for 25 years' service.

Because of ill-health, **Mr. Harry Buckley** has resigned from the board of Burco, Ltd.

Yesterday, **Sir George Usher,** managing director of International Combustion, Ltd., and chairman Aberdare Cables, Ltd., again set off for South Africa, where he is making his headquarters. He is expected to return to this country in March.

The Council of the Institution of Electrical Engineers has co-opted **Mr. G. S. C. Lucas,** O.B.E., to fill the vacancy created by election of **Sir George H. Wilson** as vice-president before the completion of his term of office as an Ordinary Member of the Council.

OBITUARY

There will be regret at the news of the death on October 11 of **Sir Geoffrey Clarke,** C.S.I., O.B.E., aged 79, formerly managing director of the Telegraph Construction and Maintenance Co., Ltd., and its associated and subsidiary concerns, who retired from that position at the end of last year on medical advice. Prior to becoming joint managing director of T. C. and M. with Mr. Willoughby S. Smith in January, 1926, he had a distinguished career in the Indian Civil Service, notably as director-general of Posts and Telegraphs. With T. C. and M., under the chairmanship of Mr. Colin Campbell, now Lord Colgrain, considerable reorganisation was undertaken about 1932, involving the concentration of the company's works at Greenwich, and the formation of Submarine Cables, Ltd. To Sir Geoffrey, who became sole managing director of the company in 1932, was also due much of the foresight for the decision to develop h.f. cables and magnetic alloys, on which much of the company's present success has been built. He was also chairman of Calcutta Tramways, Ltd., and a past president of the Association of British Chambers of Commerce. A memorial service was held on Monday last at St. Mary-le-Strand, W.C.2.

Sir Geoffrey Clarke

We regret to record the recent death of **Mr. W. H. Peters,** O.B.E., M.I.E.E., aged 52, assistant general manager of the Coventry group of works of the General Electric Co. Ltd. He originally joined the G.E.C. research laboratories in 1925, became chief engineer of the Radio Group Works, Coventry, in 1930, and nine years later was appointed manager. Further promotion followed in 1943, when he became assistant general manager of the Coventry group.

Mr. W. H. Peters

We note the death, on October 12, of **Mr. H. Tinsley,** aged 78, founder of the South Norwood scientific instrument firm of that name.

The death is reported of **Mr. H. J. Wynne,** aged 85, former chief signal and electrical engineer to New Zealand State Railways, from which position he retired in 1929.

We note the death, on October 12, of **Major G. H. Peake,** aged 91, a former managing director of the Yorkshire Electric Power Co.

New Literature

Electric and Magnetic Fields

by S. S. Attwood

FIELD theory provides the basis for most sections of electrical engineering study, and it is the purpose of this volume to give the student a thorough grounding in this subject, while adopting an approach that does not demand an advanced knowledge of mathematics. To succeed in this aim, an author has to develop very clearly the underlying concepts of field theory, and in the main Professor Attwood fulfils this criterion.

The book is divided into four sections, the first being a long discussion of the electric field. Magnetic theory based on constant permeability is next developed, with constant reference to the first section of the book, and ferro-magnetic theory, involving variable permeability, comes next. Finally there is an elementary account of the interaction between electric and magnetic fields. A feature of the book is the emphasis it places on field plotting techniques, and the obvious care that has been given to the many diagrams of lines of force and equipotentials. It is a valuable reference work for reading in conjunction with a degree course on electrical theory. Published by Chapman and Hall, 475 pages, 9 in. by 6 in., third edition, price 44s.

Photoelectricity and Its Application

by V. K. Zworykin and E. G. Ramberg.

APPLICATIONS of photoelectricity in both scientific and industrial fields are increasing rapidly. From the ordinary light-meter of the photographer to the advanced science of spectrochemical analysis, and from the sound-head of the cinema projector to the iconoscope of the television transmitter, photoelectricity is playing its vital part. Owing to the wide range of interests involved, this book is, due to its comprehensive scope, of great importance. The attack, eminently practical, is logical in presentation and detailed in information. The book is divided into two approximately equal sections. In the first is given the principles and the construction of photoelectric devices, and in the second the applications are described.

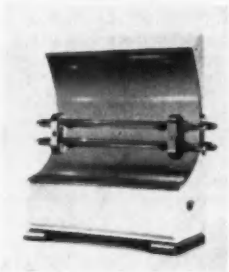
Owing to the necessity of amplifying the small impulses received from the sensitive materials, considerable space is devoted to their associated amplifiers and to electron multipliers.

This is an excellent book, well written and well illustrated and should be most useful both for practical information and for reference purposes. Published by Chapman and Hall, 494 pages, 6 in. by 9¼ in. Price 45s.

The BUYER'S *Column*

New Lightweight 2 kW Fire

ENGLISH ELECTRIC's new portable fire is a sturdy lightweight and of attractive appearance; its design in fact has been accepted by the Council of Industrial Design.



Although streamlined, the fire has a flat - backed body which permits it to stand against a wall or fit neatly into the conventional fireplace. The chrome-plated brass reflector is cleverly designed to ensure radiation in three directions and incorporates special fittings permitting easy removal of the elements. These number two, each rated at 1 kW, and are wired so that either one or both of the elements may be switched on.

Twenty inches tall, 19½ inches wide, and 8 inches deep, the fire is available in two colours, cream or black. At £10 10s., plus P.T., the Model 1003 fire is a worthwhile line to stock. The English Electric Co., Ltd.'s address is Queens House, Kingsway, London W.C.2.

Chemical Proof Clothing

IN designing protective clothing which is both comfortable and yet durable, those concerned with industrial safety have a difficult problem to face. Some years ago the Protective Industrial Clothing division of the R.F.D. COMPANY LTD., of Godalming, Surrey, carried out research into the problem in conjunction with a number of leading users of this clothing. Result of their work is the new material they have produced. It is an entirely new lightweight material and is made up into garments using a new method of sealing the seams.

The material is a high-grade cotton proofed on both sides with white polyvinyl-chloride and weighs only 8½ oz per sq yard. It is extremely flexible, is resistant to abrasion and tearing, and impervious to most industrial chemicals including nitric and sulphuric acids, alkalis such as caustic soda, oils and greases and other chemicals such as aluminium chloride and hydrogen peroxide.

The seams are first doubly sewn for strength and then sealed with a special chemical film. Garments in the R.F.D. range so far include bib and brace overalls, bib type aprons, jumpers, hoods, surgeon type coats, trousers, wader type trousers, combination suits and laboratory coats. There are three sizes and most are supplied either in white or lime green.

Improved Lens for Nife Cap Lamp

THE latest refinement of the range of Nife miniature cap lamps, made by NIFE BATTERIES LTD., Redditch, Worcester, and used extensively in the mines and for other underground work, is a new one-piece combined bezel and lens which is screwed directly on to the cap lamp headpiece.

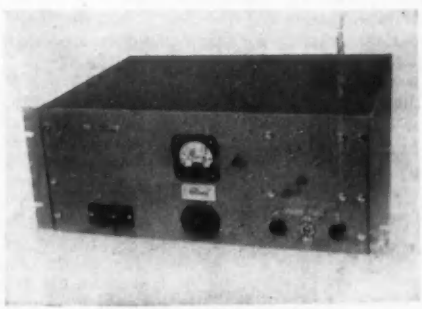
Moulded in optically pure Perspex, it possesses great mechanical strength, increases the lamp's candlepower by about 10% and provides light diffusion over a very wide angle without glare.

Plessey's Aerial Multicoupler Amplifier

DESIGNED to International Aeradio Specification, the aerial multicoupler wide band amplifier, type PV.14, introduced by THE PLESSEY COMPANY LTD., Ilford, Essex, permits the operation of up to ten communication receivers, within the frequency range 2-20 Mc/s, from one common aerial system without loss of strength of individual signals or cross modulation effects. It consists of an amplifier, preceded by a high pass filter attenuating incoming signals below 2 Mc/s, which feeds ten cathode follower stages designed to work into 75 Ω unbalanced loads.

The amplifier section consists of two identical sections each of two EF91 valves in parallel and driving five cathode followers, type ECC91. The coupling between the amplifiers and cathode followers gives attenuation of signals above 20 Mc/s, and the output response has been kept within ± 3 dB throughout the pass range. While the amplifier will handle signals up to 250 mV without overloading or the cross-talk factor becoming excessive, the attention paid to keeping the noise factor within the amplifier to a minimum also allows signals of the order of 1 μV to be handled.

Mains consumption is approximately 130 watts, and the unit is designed for operation on the standard 200-250 V, 50 c/s supply and also on 110 V 60 c/s supplies.



Plessey's PV.14 amplifier

Presentation by Remington

A SUBSTANTIAL and attractive new presentation case is now supplied by REMINGTON RAND, LTD., of 1-19 New Oxford Street, London W.C.1, with all standard models of their electric dry shavers. The outer covering is of pony grained rexine on metal, and the two-section inner tray is lined with maroon velveteen. The lid lining is of ivory satin and the edges of the pack are fitted with chromium plated bezels. Dealers will find this an additional factor in their sales drive. It ties up with the effective sales aid which we described in our issue dated October 5.

Get Ready for the Festival!

DETAILS of their 1950-51 range of floodlighting lanterns have now been released by ROWLANDS ELECTRICAL ACCESSORIES LTD., R.E.A.L. Works, Hockley Hill, Birmingham 18.

They come at an appropriate time when without doubt dealers, service centres and contractors everywhere are receiving many enquiries for floodlighting for the 1951 Festival of Britain.

The R.E.A.L. range comprises lanterns and projectors for use with gas-filled, "B" type, mercury discharge and sodium vapour lamps, and it includes two new types, the "Festival" 100/200 W and 300/500 W flood lanterns. List Nos. 771, 773, and 775 are for 100 W, 150 W and 200 W respectively, and are developments of the original "Jubilee" range, and their cost is well below normal hire charges for this equipment. Prices are 30s., 35s. and 60s. again respectively. List No. 777 is for 300/500 W g.e.s. lamps and is generally similar to the other three. Price here is 92s. 6d. For efficiency combined with value these R.E.A.L. lanterns rate very highly. Dealers will find useful the new list which will be soon available.

The R.E.A.L.

List No. 775

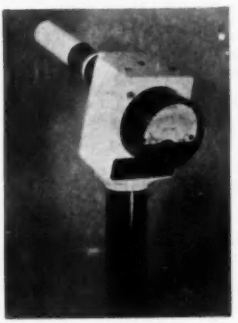
Safe from Static Charges

STATIC electricity generated in the course of a host of normal processes can be a definite hazard in many industries. In spinning fibres, for example, the mechanical forces set up can be distinctly detrimental to the process, and the possibility of spark discharges constitutes a grave risk of fire or explosion in other processes.

In order to investigate and to assess the effectiveness of corrective measures the Dunlop Rubber Co.'s Research division developed a portable instrument which was capable of measuring these electrostatic charges.

This meter has now been re-designed by the BALDWIN INSTRUMENT CO., LTD., Brooklands Works, Dartford, Kent, and is available in robust and handy form for laboratory and workshop use.

The principle of operation is as follows: A small voltage, proportional to that being measured, is induced by capacitive coupling on to the grid of an electrometer valve. The anode current of the valve is measured by an indicating meter in terms of the inducing voltage divided by the distance separating its source from the instrument. Measurement is then of voltage gradient or volts per foot.



The "Statigun"

The following measurements and ranges are covered: (1) Voltage gradient, the instrument being scaled up to 2,000 volts per ft. (2) Quantity of charge from 1×10^{10} coulomb/cm^2 to 2×10^{-9} coulomb/cm^2. (3) Resistance from 10^7 to 10^{13} ohms (this can be extended to 10^{15} ohms). (4) Capacitance of bodies insulated from earth, this being estimated by charge sharing from 5$\mu\mu$F. to 0·2 μF. Weight of the "Statigun" illustrated above is 3½ lb., overall dimensions are 10 in. by 9 in. by 3 in. It is available with a canvas carrying case or a wooden case. Readers will remember our reference to this instrument in our issue of 14 September.

TRADE PUBLICATIONS

ELECTRICAL ENGINEERING. Reprints in their section in the 1949/50 BEAMA catalogue are now available from Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester. They call the brochure "Principal Products."

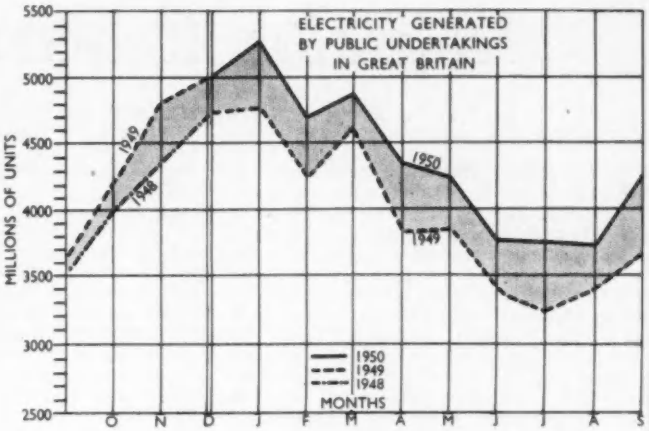
FLUO FITTINGS. A 32 pp. brochure giving a full range of fluorescent lighting fittings and equipment has been published by Siemens Electric Lamp and Supplies, Ltd., 38-39 Upper Thames Street, E.C.4.

Units Generated

4,250 million units was the total energy generated during September, 1950, in stations under the control of the B.E.A., the North of Scotland H.E. Board, and the Lochaber Power Co. The corresponding figure last year was 3,672 million, so there has been an increase of 15·7%.

Of the total, 4,065 million units were generated in steam stations and 167 million in hydro electric.

Energy sent out during the month was 4,016 million units, 94·5% of that generated. This gives the total for 1950 so far as 36,720 million units, an increase of 11·1% on the corresponding period of 1949.



POWER SUPPLY IN SEPTEMBER

ONE new post-war station figures amongst the plants mentioned in the B.E.A. installation list for September. This is Croydon B, in the South-Eastern Division, where a start has been made with the commissioning of a 52·5 MW turbo-alternator (Metropolitan Vickers) and a 320 klb/hr Simon-Carves boiler. The South-Western Division makes one of its widely spaced appearances with Hayle, where a 200 klb/hr Yarrow boiler has been brought into service.

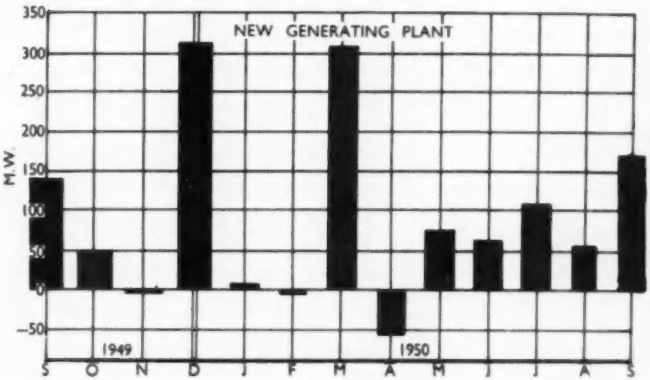
In the Midlands there is Nottingham (E. Midlands Division) with the second B.T.H. set of its scheduled extensions, this time a 52·5 MW machine. Two boilers remain to be commissioned to complete extensions here. In the Midlands Division, Walsall is in the news again with the installation of the seventh Babcock & Wilcox 180 klb/hr boiler.

Finally, in the list is Neepsend (Yorkshire Division), where the 50 MW set due for installation has now been commissioned. The machine is of Metropolitan Vickers manufacture.

Details of the North of Scotland 20 MW increase are not yet available, but the 33 MW recorded as last month's increase for the H.E. Board is now known to be the second English Electric vertical Francis type water turbine at Loch Sloy.

Generation

Of the total units generated 9,137 million came from B.E.A. stations, and 113 million from the North of Scotland. The B.E.A. generated 76 million units in water power stations, and the N. of S. Board 91 million units in the same way. These totals are the highest yet recorded for hydro-electric output on either system.



Generating Plant

At the end of September, 1950, the installed generating capacity of the B.E.A. was 14,213 MW, 169 MW more than at the end of August. The North of Scotland total was 433 MW, showing an increase of 20 MW during September. The figure for overall increase during the last twelve months becomes 1,082 MW, or 8%.

The installed capacity used for the purpose of this graph should be distinguished from the output capacity. The installed capacity is the total m.c.r. of all the generating sets which are connected on both steam and electric sides, and are suitable for service.

National Research

D.S.I.R. Report Summarises Year's Work

GOVERNMENT research policy was discussed in detail during 1949, and the decisions taken are now guiding the selection of work to be carried out. Two conferences were held, and a summary of the conclusions reached is contained in the D.S.I.R. Report for the year 1948/49, which has been recently issued by the Stationery Office. In this the Advisory Council of the department points out that the purpose of the various Government research establishments is to investigate problems of concern to the nation as a whole; the research associations, on the other hand, primarily meet the needs of particular industries, although they receive financial grants from D.S.I.R.

Eminent scientists and industrialists make up the boards of the establishments, and advise on the subjects for investigations, and it is noted that two matters are causing them particular concern. First comes the difficulty of ensuring that adequate scientific effort is given to every problem accepted for investigation; in other words, of seeing that there shall be no excessive dissipation of resources. Secondly, there is continued apprehension concerning the relative lack of basic research being undertaken. Both these difficulties are intimately linked with staff recruitment problems, and no rapid solution is considered likely.

In the research associations the choice of subjects for investigations is the responsibility of the various councils, which include representatives of D.S.I.R. and of interested Government departments in order that the Government's desires in the matter of research may be considered when programmes are worked out. Reporting differences of opinion on one detail of policy, the Advisory council states as its view that the activities of the associations should not be confined to laboratory studies of materials and processes but should also embrace economic and sociological investigations, where these are appropriate.

Applying Results

Problems of ensuring application of the results of research are also discussed in the report. In an industrial firm, research can be closely related to market possibilities but this is not possible when the work is carried out in a Government department, or even in a research association. Sometimes the setting up of pilot plants provides the answer, but this step is by no means always necessary. Ultimately, it is considered the presence of reasonably large numbers of technically trained men in the industry concerned is necessary, if full value of research activities is to be obtained. As a matter of policy, great efforts are being made to ensure that all research is carried to the point where it can be taken up by industry. It is felt that as industry employs more scientists, much knowledge that at present has to be pushed in from outside will be pulled in from inside, with more effective use at an earlier stage.

Amongst the more detailed matters discussed in the Advisory Council's Report is the making of a grant to the Manchester Joint Research Council to assist it in a special survey of the use of science by firms in the north-west. The inquiry is to apply primarily to small and medium sized organisations, and is to cover such matters as whether the firms are getting the right kind of science graduate, and whether research reports are reaching them in the most effective form.

Summary of Work

Twenty pages of the Report are given over to the remarks of the Advisory Council and the covering note of Mr. Herbert Morrison, Lord President of the Council; the remaining 249 pages contain a detailed summary of the work of the D.S.I.R. departments and the research associations. Much of the information contained has already been published in the individual reports of the various organisations, and this is the case with the Electrical Research Association, for instance. Nevertheless, the summary has a special interest of its own on account of the overall picture it gives of the work being carried out in this country, and of the manner in which electrical engineering and allied knowledge is being applied.

The remarks on the work of the Building Research Station provide an example of this interest. After describing such items as the investigation of bridges to avoid too high a factor of safety, the summary goes on to describe how the "criterion" technique for assessing subjective factors, developed in connection with street lighting investigations, has been successfully applied to problems that arise in the design of daylighting of schools and factories. Again, the fuel research report describes how the Boiler Availablity Committee is being helped by investigation of the effects of the properties of the coals burned. In the period under review this work led to the correlation of almost all the deposits with the occurrence of sulphur, phosphorus and the alkali salts in the coals used.

The development of infra-red drying in shoe manufacture is noted in the report of the Boot, Shoe, and Allied Trades Research Association, while the elimination of static electricity troubles has been studied by the Cotton Industry Association. A new association, the British Hydromechanics Research Association, only came under the aegis of D.S.I.R. in 1948, and spent most of the year under review in planning work. With programmes of investigations into such subjects as water turbines and water hammer in pipes it should eventually produce much information of interest.

THE WEEK

INDUSTRY *in news* COMMERCE

Power Exhibition for 1951 Festival

A REMARKABLE preview has been released this week giving details of the Exhibition of Industrial Power to be held in Glasgow from May 28 to August 4, 1951, as part of Scotland's Festival of Britain celebrations. The theme of the exhibition will be man's conquest of power, and in the main Hall of Power will be a huge cliff of coal with a stairway rising under it to the coal sequence of the exhibition, and on the opposite side will be a glass tunnel rising to the water sequence. Twenty thousand gallons of water a minute will cascade down on to the tunnel and will undoubtedly provide visitors with a vivid impression of what water power means.

In the electric power section the story of electricity will be told under headings of generation, distribution and consumption. Modern equipment used for generating electricity will be exhibited by means of models of turbo-alternators and trip alternators. Distribution will be exemplified by the installation of transformers, circuit-breakers and a steel transmission tower, while the third chapter of the story will cover both industrial and domestic uses of electric power. Another part of particular interest to electrical engineers will be the hydro-electric section, where details of projects will be described in a series of bays showing the preparation of a hydro power site, driving of a tunnel, building of a dam, erection of a power station and the dams now completed. A typical croft kitchen of some years ago will be set up for comparison between the old paraffin lamps, oil heaters and petrol stoves, and the lighting, cooking, heating and labour-saving devices in modern Highland homes.

Other sections of the exhibition include those devoted to steel, steam engines, civil engineering and ships and railways. The final presentation will be the power source of the future—atomic energy. A metal cone will project from the floor and flashes of lightning will be thrown from its top towards the starry sky represented by a dome 90 ft in diameter. The cone is the working head of the Tesla machine, the electrical testing apparatus generating a million volts.

M.P.s see Electrical Industry

DURING the parliamentary recess M.P.s have been busy touring factories and industrial areas, gaining first-hand information on conditions and output which will no doubt serve them in good stead in their parliamentary duties. Several electrical firms were among hosts to ministers and members. Hoover Ltd., for instance, entertained the Minister of Supply, the Rt. Hon. G. R. Strauss, who toured the company's washing machine factory at Merthyr Tydfil and saw work in progress on the works extension.

Mr. Anthony Eden has also been keeping in touch with industry, and visited the Warwick works of John Harris Tools Ltd., to see for himself the production of precision ground thread taps and dies. New products he inspected included the master tapping gauge, Winnet tungsten carbide screw plug gauges and the quick spiral tap. Also on Mr. Eden's list of autumn visits was the B.T.H. factory at Rugby, where after a tour of the factory, he visited Coton House, the hostel for apprentices. In the evening he was guest of honour at the annual dinner of the B.T.H. Overseas Association.

Photo-finish in the Air

AN experiment which is likely to become as popular at air races as the photo-finish camera in horse racing, was carried out at the *Daily Express* air race from Hurn to Herne Bay. One of the G.E.C's table model magnetic tape recorders was installed at each end of Herne Bay pier, the mile-long finishing line of the race, and observers were able to make independent records of the order in which aircraft crossed the line. The tape recorders will probably prove invaluable assets in the event of close finishes, especially in these days of "faster than sound" planes, and the Royal Aero Club, under whose auspices the race was held, is completely satisfied with the first use of the recorders for assisting the judges.

The First Half-Century

It has long been a reproach to the West End of London that street lighting has been quite un vorthy of the most fashionable part of the richest city in the world. The city was lighted electrically before more than an occasional or experimental arc lamp appeared in the West. In 1897 the St. James's Vestry did something to remove the reproach and since then we have seen a gradual increase in the number of arcs westward. But the parish of St. George's Hanover Square lingered behind the rest. The influence of the gas interest in the Vestry proved sufficient to prevent any rapid progress being made. Now, however, the party of progress has conquered by sheer dogged perseverance.—(*From our issue of October* 18, 1900.)

Work in progress on the new generating station now under construction at Brighton. Sea water for turbine condenser cooling will be pumped through the gravity conduit (in foreground) running into the turbine house. Foundations have been built on a raft with nearly 5,000 reinforced concrete piles. First half of the station will comprise three turbo-alternators and six boiler units, and is scheduled for completion by late 1953.

Transmigration of Trams

SCRAPPING of over 700 of London's trams, taken out of service at the beginning of the month, is not proving a wasteful project, as George Cohen and Co. Ltd., who are dismantling them at the newly christened "tramatorium" at Charlton, are recovering large quantities of valuable material for re-use in industry. Before setting fire to the trams, the glass, brasswork, electrical fittings and upholstery are being salvaged for sale. After the burning, ferrous and other metal parts are easily removable and iron and steel scrap is derived from chassis bogies and motors. The electrical gear yields copper and other non-ferrous metal. Those who have a soft spot for the London trams may be relieved to learn both that "disrespectful" enquiries from people wishing to use them as dwellings have been refused, and that the trams will be reincarnated even if the process involves passing through the scrap heaps.

Bedford Works' "Open Day"

THREE visitors from the Commonwealth were among 3,000 guests who toured the Igranic Electric Co.'s works at Bedford recently, when that firm held its second annual "open day." The 25 departments thrown open for inspection included the drawing office, mechanical assembly and carpenters' shops, and while visitors passed through the shipping department they saw equipment being packed ready for export to Holland, Calcutta, New Zealand and South Africa. The tourists had a grand opportunity of seeing factory life and industry in general, as it is Igranic's proud claim that their work is associated with every modern industry. Highlight of the day was the signing of a rather unusual visitors' book, which was installed in a special casing and automatically recorded the number of guests by means of a photo-electric cell.

Firm celebrates a 25 Years Link

RADIO and electrical engineers in the West Country around Bristol and Weston-super-Mare were guests at a dinner and cabaret given last week by F. O. Coward Ltd., the Bristol auto-electrical equipment specialists. Nearly 250 were present to celebrate the firm's silver jubilee of its association with Exide and Drydex batteries. The company was formed in 1924, when Mr. Coward acquired a small business and began the servicing of electrical equipment of road vehicles. It is interesting to note that one of the company's first jobs was to convert a number of local buses from acetylene and oil lighting to electricity, and it was then that the association with Exide began.

Norway-Denmark Cable Joints

THREE-CORE flat type cables (of the type described in the ELECTRICAL TIMES for Sept. 7, page 365) are being used for the new 132 kV Norway-Sweden-Denmark link. These cables, manufactured by the Northern Cable and Wire Works, Copenhagen, are of 185 sq mm. section and weigh 40 kg/metre for the submarine portion and 27·7 kg/metre for the land portion.

As there are cliffs 40 metres high on both shores, stop-joints are being installed half-way up each cliff. These are being manufactured by Pirelli General Cables Ltd. They are similar to the usual type of oil-filled cable stop joints. The joints are built up with paper tape insulation applied over a connected pair of porcelains, and consist of three such pairs of porcelains into which the suitably prepared cables are inserted, electrical continuity being preserved by flexible connections enclosed within stress controlling screens. The

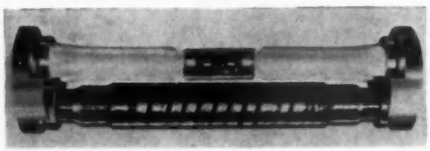


illustration shows a stage in construction with one pair of porcelains completely taped. Each joint is permanently sealed, dried under high vacuum and impregnated with oil before leaving the Pirelli-General works. A small pressure tank is connected to allow for expansion and contraction of the oil. This tank is removed after installation of the joint.

"I could a Tail Unfold . . ."

MIRANDA was the choice of the G.E.C. Dramatic Society for this season's production at the Fortune Theatre on Wednesday, Thursday and Friday of last week. Once again, the general standard of production was so high that it was difficult to realise that one was watching an amateur show—by the same token, it is difficult to single out any individual performance, since this play does not, in spite of its title, entirely revolve around one central character, but depends on teamwork and timing of a very high order—which it undoubtedly got.

The mermaid herself was played by Evelyn Rush, while Paul and Clare Marten were played by Millar Dixon and Moira Threlfell. Betty Michell and Michael Molloy took Isobel and Nigel, Kitty Wright and Ian Stewart played the housemaid Betty and the chauffeur Charles, while Norah Symonds gave a spirited performance as Nurse Carey. Production was by T. Hervey Noble.

Women censure Manufacturers

WOMEN'S opinions on electrical appliances in the home are always worth considering, particularly as they probably know most about the practical use of cookers, fires, irons and the like. The subject of electric fires cropped up at the conference of the National Council of Women at Bournemouth last week, and one delegate, Mrs. Vera Colebrook, had a few scathing remarks to make against manufacturers. A committee of manufacturers had been sitting for 3½ years, she said, studying the question of adequate fireguards, during which time she had seen children severely burnt. She urged that the matter should now be taken out of commercial hands. A delegate from Hastings also criticised the manufacturers, saying they had not shown themselves to be co-operative in providing guards.

After the discussion the women passed a resolution expressing their deep concern at the alarming increase in the number of accidents caused by unprotected gas and electric fires, and urged that adequate guards should be compulsory. They suggested that the Council of Scientific and Industrial Research should be encouraged to develop non-inflammable materials. Resolutions such as this are often good pointers and give some indication of what the customer would like, a matter manufacturers should bear in mind even if the critical housewife will invariably be able to find fault with designers' masterpieces.

Scene from G.E.C. Dramatic Society's production of "Miranda," showing (left to right) Michael Molloy as Nigel, Evelyn Rush as the mermaid and Millar Dixon as Paul Marten

Electricity not a Thing Apart

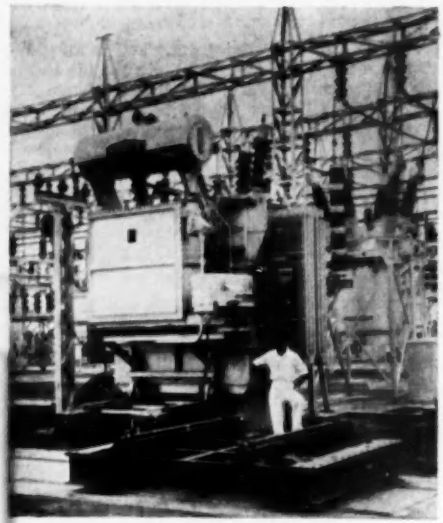
A CLOSER and more intimate relationship between the Board and the public was the aim of the S.W. Scotland Electricity Board's exhibition, said Provost Robert Boyd when he opened the three-day show at Greenock Town Hall last week. He said that when electricity was nationalised many feared it would become a thing apart from the general public, but the exhibition proved that the Board did not intend that state of affairs to exist. Final evening was devoted to a cooking competition in which senior pupils from local schools took part.

Few Queries put to S.E. Board

THERE was no great rush to ply representatives of the S.E. Electricity Board with questions when the Board's sixth meeting with manufacturers to discuss purchasing policy was held at Brighton on Friday. Mr. W. R. T. Skinner, deputy chairman of the Board, remarked that never had he seen 185 manufacturers so quiet. Records showed, however, there had been a steady increase in attendance from 112 at the first meeting in April, 1948, and, said Mr. Skinner, either the meetings were stimulating or Brighton still retained its attractions.

Among points in his opening speech Mr. Skinner referred to the matter of decentralisation. An up-to-date proportion was that 6·5% of S.E.E.B's orders had been placed centrally between March and August, or about one-third of what it was two years ago. Only by determined and positive efforts outwards could decentralisation be maintained.

The deputy chairman dealt with two questions he had received in advance. One question dealt with immersion heaters and asked whether the B.E.A. should refuse to connect 4 kW domestic heaters to their mains. The questioner said his firm had refused to make them, but the heaters



One of the trains now in service on the electric railway serving the holiday resort of Estoril, Portugal and the suburbs of Lisbon (above); and (left) a transformer installed at Pallisvasal for the Government of Travancore, India

were being manufactured by some firms to escape the purchase tax. Customs and Excise had threatened to raise the tax range to include 6 kW heaters. Mr. Skinner replied that S.E.E.B. was not in favour of encouraging such a method of avoiding tax, nor would they recommend such installations. He added that so far this year supply of 4 kW heaters was less than half of 1% of the total installed. The second asked whether S.E.E.B. insisted on British Standards for their purchases, particularly relating to electrical accessories. They did make the greatest practicable use of B.S.S., said the deputy chairman.

From the body of the hall, Mr. W. J. Bird of G.E.C. said there was a tendency in some areas to press for a good basic cooker stripped of all its frills and at a much reduced price, and was the S.E.E.B. also asking for that? Mr. Skinner replied, "Not so far, and for myself I cannot see the need for nor the wisdom of such a move." The Board's chief commercial officer, Mr. C. F. Wells, had a word to add here, saying, "We do have to face the competition of the gas industry and we do want something to compete with their lower-priced cookers." Concerning decorative lighting for the Festival of Britain, Mr. Skinner said that a tariff had been approved and he thought it would fit in with requirements for what will probably be a considerable load.

Exports to India and Portugal

TWO large export orders involving transformers and electric railway rolling stock have recently been completed by British firms. Brush Electrical Engineering have installed two 4,000 kVA transformers of 66/11 kV at Pallisvasal for the Government of Travancore (India) hydro-electric scheme. The transformers are provided with "on load" tap changing equipment and are arranged for remote electrical control.

The supply of two motor coaches, five trailers and an electric locomotive for the Estoril electric railway in Portugal by the G.E.C., has been followed by another order for similar rolling stock. The railway is electrified at 1,500 V on the overhead system, and besides connecting Lisbon with the busy holiday resort of Estoril also serves the residential areas on the north bank of the River Tagus.

Revaluation of the Speed of Light

CONFIRMATION of the new value of the speed of light has now been announced by Dr. L. Essen of the National Physical Laboratory. This speed, derived by radio type measurements using a resonant cavity technique, is 186,282 miles per second instead of the 186,271 miles per second as derived in the classic measurement of Michelson, which utilised a direct means of measurement. Although small in quantity the revaluation will have a considerable effect in radio, radar and nuclear physics.

P.O.A's First Commonwealth Branch

AT the annual conference of the Purchasing Officers' Association held at Brighton recently, Mr. D. Firth, the national chairman, reported that the Association now had 30 branches and groups scattered throughout the U.K., with a total membership of over 2,300. The year was particularly notable for the formation of the first Commonwealth branch in Natal. He asked for increased support of the education scheme for junior members, and in that connection said that during the past year the Association's Final examination had, for the first time, been passed by several students. An innovation at the conference was the "Minibition," where nearly 100 companies covering a wide range of industry were able to exhibit their products.

New Hoover Films

TWO new films produced for Hoover, Ltd., by Publicity Films, Ltd., were shown to the Press on Monday of this week. The first, "It's About Time," is a direct sales film which sells the Hoover idea by telling a story. The second, "Consider the Carpet," has a very different approach, since the major portion is a straight documentary which tells the story of carpet manufacture, from hand weaving to modern high-speed, automatic machinery, and demonstrates how the various kinds of dirt and grit differ in their effect on carpets and the difficulties of removing them. Forming a part of the service to dealers, these films are also available for stores, exhibitions, technical institutes and women's associations, being available in 16-mm. size.

The Thor "Stowaway"

WE have been asked to point out that the coupling device used in the Thor "Stowaway" washing machine, between the main drive and the wringer, is not, strictly speaking, a dog-clutch but is a direct slotted drive with a serrated sleeve.

NEWS IN BRIEF

An up-to-date list of its members has been published by the Association of Consulting Engineers, 36 Victoria Street, S.W.1, price 1s. 6d. to non-members. In addition to being presented in alphabetical order the names are also listed geographically.

A new Scottish branch of E.A.W. has been formed, making the eleventh branch in Scotland and the Association's 108th.

The annual meeting of the Hampshire and Dorset branch of E.I.B.A. will be held at 4 p.m. next Thursday (Oct. 26) at Southern Division Headquarters of B.E.A., 111 High Street, Portsmouth.

As from last Monday church bells and their auxiliary mechanism are exempt from purchase tax. The announcement is made in "Purchase Tax (No. 9) Order, 1950."

The English Electric Co. recently entertained Dr. R. R. Schreiber and Dr. E. E. Buero, the Peruvian and Uruguayan Ambassadors who toured the company's Stafford works and Nelson Research Laboratories.

Electric Supply News

Barry

Some protest was made at the Barry Council meeting last week against the action of the South Wales Electricity Board in offering to lay a cable for electricity supplies at Colcot Estate only on condition that 72 of the houses were provided with electric cookers. The Board had said that, alternatively, the Council would have to pay £3,262 towards the cost. The council accepted the arrangement as a matter of urgency, but on condition that it did not constitute a precedent.

Bangor

This month marks the fiftieth anniversary of the inauguration of electricity supply by the Bangor Corporation. After acting as clerk of works for the erection of the generating plant and distribution system, in 1899, Mr. Price F. White became borough electrical engineer in October, 1900, a position he held until retiring in 1940, when he was succeeded by Mr. F. O. Harber. Originally the plant comprised two water tube boilers and two 60 kW Willans engines and dynamos.

Borrowdale

The cost of erecting o.h. cables to Borrowdale would be about £20,000, while annual revenue would be approximately £1,000, said Mr. J. E. Shepherd, manager of No. 6 sub-area, North-Western Electricity Board, at a meeting of the Consultative Council recently. To place the cables underground, he said, would involve an expenditure of £53,000, and if they had to do that to comply with the wishes of the amenity societies in the National Park area it would be totally uneconomic. The discussion arose from a resolution sent by farmers in the Macclesfield area suggesting that the cost of installation in country districts should be reduced by sharing the capital outlay with urban and similar areas. Members did not endorse the resolution because many felt that farming was a business, and, as such, should bear the charges the same as other industrial undertakings. As a help to gardeners and to encourage more food production, it was decided to ask the Board to consider the introduction of a special tariff for horticulturists. Members were of opinion that if a guaranteed supply was available at night, many people would avail themselves of the service at a lower charge.

East Kilbride

The South-West Scotland Electricity Board have just approved a scheme for the reinforcement of the network in the East Kilbride area, at an estimated cost of £41,700. This is a portion of the work involved in the development of new supplies in the area, which is anticipated to cost approximately £440,000. The new town at East Kilbride, some 8 miles from Glasgow, is growing steadily, and the maximum demand in that area is expected to increase by 5·8 MW from the present 0·9 MW in the next few years. During this period the East Kilbride Development Corporation are planning to erect 3,900 houses and shops, six schools, a community centre, a cinema, two industrial estates having a factory capacity of 340,000 square feet, office accommodation of 70,000 square feet, and premises for the Department of Scientific and Industrial Research.

Lurgan

Although wired for lighting and cooking, 22 new houses built by Lurgan R.D.C. are without a supply. Apparently the Armagh County Council has given the Electricity Board for Northern Ireland approval only on a temporary basis to the erection of poles for h.t. lines—to ensure that there is no interference with any future re-alignment of roads. But the Board has intimated that it is not prepared to proceed on such a basis as it might involve them in needless expense.

New Station and Extensions

The B.E.A. has now received the consent of the Minister of Fuel and Power to the establishment of a new power station—Meaford B—near Stone, Staffs., which is to have four 60 MW turbo-alternators, four 515 klb/hr boilers, and three cooling towers. Thus the capacity of the new station (240 MW) will be double that of the existing Meaford A station, which was completed early last year. Consent has also been given to the development of the new Skelton Grange station, Leeds, to its full capacity of 360 MW, by the installation of three more 60 MW turbo-alternators, with three 550 klb/hr boilers and two cooling towers.

N. Wales

The Merseyside and North Wales Division is collaborating with the B.E.A.'s Research Department in connection with an experimental wind-driven generator which is being erected on Mynydd Anelog in North Wales. The generator, of the Andreau type, will have an output of 100 kW. It is being built by Enfield Cables, Ltd., in conjunction with De Havilland Propellers, Ltd. The generator will be 130 ft high, and at a wind speed of 28·6 m.p.h. the three-bladed propeller, which has a diameter of just over 78 ft, will rotate at 106 r.p.m. The machine works on the Andreau principle, the propeller operating as a centrifugal blower to provide power for the air-turbine and generator which are mounted at ground level. It is hoped that the machine will be in commission for the winter of 1952-53.

LIGHTING SCHEMES

Alton (Hants) U.D.C.—The proposed street lighting scheme for the town has had to be deferred, in view of the revised policy of the M.o.T., it was reported at the recent Council meeting.

Bollington (Ches.).—U.D.C. to install 102 electric street lighting units, at an estimated cost of £2,400.

Bradford.—The Corporation lighting sub-committee has agreed in principle that the high pressure gas lighting system in the central area of the city should be converted to electricity. A conversion scheme is to be drawn up, with an estimate of cost.

Coventry.—Plans for improved lighting from Broadgate to the Craven Arms, Burley, along Binley Road, have had to be modified. The Road Safety Committee has decided that for the present, the new lighting shall be taken only as far as Stoke Hill. The committee has also discussed the improvement of lighting in side streets, in connection with the decision to convert the system from gas to electricity. Four experimental sections of lighting are to be studied.

Halesowen.—The T.C. have under consideration a proposal for the replacement for gas lamps by electricity on all main roads, at a cost of £4,522.

Haverfordwest.—The T.C. is to submit a scheme for electric lighting of trunk roads in the borough to M.o.T. for urgent approval.

Helensburgh.—T.C. to convert gas lighting on the stairs and courts of tenements, at a cost of £2,630.

Hungerford.—The R.D.C. has approved a scheme for electric lighting in Charnham Street, at an estimated cost of £2,385.

Spalding.—The U.D.C. has made application for consent to a scheme to convert the existing gas lighting to electricity. Included in the scheme are 23 fluorescent lamps for the centre of the town.

Company Activities

Bennis Combustion

Trading profit for the year ended April 30, last, was £84,738 (*£140,267*) and income from investments, etc., £2,436 (*£1,294*), making £87,174 (*£141,595*). To depreciation on fixed assets £5,743 (*£5,902*), directors' emoluments £9,806 (*£6,392*), audit fee £450 (*£300*), taxation £36,500 (*£65,000*). Deduct cost of past service pensions £16,128, less staff fund no longer required £12,500. Provision against investment in a subsidiary to cover its intangible assets £3,572, and adverse balance £12,602. Special bonus £2,000 (*£3,000*), staff fund nil (*£4,939*), general reserve, nil (*£43,500*), Preference dividend £3,300 (*same*), Ordinary 5% interim £2,062 (*£6,187*). Final Ordinary 10%, £4,125 (*nil*), leaving £14,644 (*£11,258*) carried forward.

Bendix Home Appliances

For the year to April 15, trading profit was £139,836 (*£106,623*), plus investment income £617 (*£1,119*), underwriting commission nil (*£400*), and provision for servicing costs written back nil (*£15,750*), making £140,453 (*£123,892*). To depreciation £2,885 (*£4,871*), directors' emoluments £6,742 (*£13,122*), investment reserve nil (*£2,287*), expenses increasing share capital and revising articles nil (*£1,812*), taxation £77,000 (*£60,433*), leaving net profit £53,826 (*£41,367*), plus surplus on realisation of investments nil (*£11,539*), and with £48,918 (*£10,477*) brought forward, there is £102,744 (*£63,383*) available. To Preference share redemption fund £40,000 (*£10,000*), premium on Preference shares redeemed

£4,000 (*£1,000*), Preference dividend £1,980 net (*£3,465*), leaving £56,764 carried forward. There is no Ordinary dividend (*same*).

British Electric Resistance Co.

Preliminary statement shows net profit for the year to July 31 last was £10,852 (*£12,001*), after charging profits tax £4,100 (*£4,500*), and income tax £5,400 (*£10,500*). To dividend equalisation £2,500 (*same*), general reserve £2,500 (*£3,000*), final dividend 15%, making 20% (*same*), leaving £8,264 (*£7,912*) carried forward.

C.V.A. Jigs, Moulds and Tools, Ltd.

Trading profit for 1949 was £59,037 (*£83,242*), after crediting development expenditure £52,341 (*£36,746*), profit on exchange £748 (*nil*), and registration fees £3 (*£12*), and after charging depreciation, obsolescence, amortisation and amounts written off totalling £61,548 (*£58,496*), and directors' emoluments £7,300 (*same*). To profits tax £10,372 (*£14,100*), income tax £22,788 (*£34,236*), leaving £25,877 (*£41,387*). With £21,019 (*£17,030*) brought in, there is £46,896 (*£58,417*) available. To interest on loan stock, less tax, £7,425 (*£1,856*), Preference dividend £10,587 (*£7,184*), Ordinary dividend 6% £8,250 (*same*), general reserve nil (*£20,108*), leaving £20,634 carried forward.

Madras Electric Supply Corporation

Stockholders are informed in a circular that the Madras Government has made a final firm offer for the undertaking. The offer is as follows: £1,612,500 for the undertaking, excluding the service connection lines paid for by consumers (reserved for arbitration); or £1,635,000 for the entire undertaking, without arbitration on any issue. In the opinion of the liquidators, the first of these alternatives is acceptable, bearing in mind that if the value of consumer services, £84,546, is eliminated from the consulting engineer's valuation of £1,794,725, there is left £1,710,179. The Government offer, of £1,612,500, shows a reduction of £97,679 on this figure. As against this, the company will receive more than £50,000 in respect of interest on unpaid purchase money. Also to be borne in mind are the points that the Government has the right to appoint the sole arbiter in any arbitration proceedings, which would obviously be both lengthy and costly. An extra-ordinary meeting is to be held next Thursday, October 26.

J. and F. Stone Lighting and Radio Ltd.

For the year to June 30 last, trading profit and sundry income is £412,077 (*£380,065*). To taxation £190,175 (*£175,985*), leaving net profit £149,131 (*£129,987*), and carry forward £102,797 (*£54,116*). There is a final dividend of 30%, making 40% (*same*).

Max Stone

Consolidated trading profit for the year to June 30 last was £238,985 (*£232,605*), plus fees, etc. £81 (*£454*), making £239,036 (*£233,059*). To depreciation £13,423 (*£10,012*), repairs £2,405 (*£5,055*), directors' fees £1,500 (*same*), other emoluments £23,170 (*£18,249*), audit fee £875 (*same*) and taxation £113,616 (*£113,929*), leaving net profit £84,047 (*£83,439*). To general reserve £60,000 (*£57,000*), Ordinary interim 20%, making 40%, £19,800 (*same*), leaving carry forward of holding company £34,492 (*£37,864*) and of subsidiary £16,751 (*£13,092*).

Rangoon Elect. Tram. and Supply Co.

For 1949, profit was £15,730 (*£18,397*). To employees' allowance reserve £3,000 (*nil*). Preference dividend for the year 1944 £15,000 (*same*), and there is £26,469 carried forward. The report states that the £235,915 received from H.M.G. on February 27, 1950, as ex-gratia assistance towards rehabilitation has been paid over to the Government of the Union of Burma in reduction of their loan to the company. This payment will be included in the 1950 accounts. The agency agreement expired on September 30, 1950, and was not renewed.

Shanghai Electric Construction

For 1949, traffic receipts were £958,876 (*£922,518*), plus Chinese Government subsidies, nil (*£15,166*), interest, etc., £6,209 (*£5,133*), making £965,085 (*£942,817*). To power expenses £639,837 (*£541,049*), repairs and maintenance £202,605 (*£81,070*), general expenses £76,660 (*£81,306*), royalty and trolley bus road maintenance £49,485 (*£53,540*), business tax £3,597 (*£12,740*), audit fee £1,025 (*£900*), directors' fees £1,839 (*£1,680*), depreciation £30,074 (*nil*), interest on bank loans £58,770 (*nil*), war damages, part, £46,767 (*nil*), making the loss for the year £226,719 (*loss £37,683*). With debit of £35,450 brought in, the debit carried forward is increased to £262,169.

Stream-Line Filters Ltd.

Trading profit for 1949 was £42,272 (*£24,442*). After charging depreciation and directors' remuneration and making provision for taxation of £17,704 (*£8,700*), there remains £9,647. Dividend for year 12½% (*same*). Carried forward £19,956 (*£17,184*). Interim dividend 5% for 150, payable on November 9.

Worthington-Simpson

Treasury consent has been obtained to the issue of 320,000 of the 10s. Ordinary shares as capital bonus to Ordinary shareholders, by the capitalisation of £160,000 take as to £59,953 and E.P.T. post-war refund reserve and as to £100,047 from general reserve. They are to be issued on the basis of one for every two Ordinary shares held.

Dividends Declared

British Aluminium Co. Interim dividend of 4% (*same*).

Calcutta Electric Supply Corpn. Interim dividend of 3% tax free (*same*).

Glenfield and Kennedy Ltd. Ordinary interim dividend of 5% (*same*), payable on December 1.

Commercial Information

CONTRACTS OPEN

HOME

Oct. 20.—Carlisle. Six vertical spindle motor-driven pumps and accessories, capacity 38 million gall. per day. L. J. A. Stow, City Engineer and Surveyor, City Engineer's Office, Carlisle.

Oct. 20.—Inverness. Electrical installation at Hearing Aid Clinic, Royal Northern Infirmary, for N. Regional Hospital Board (Scotland). Board Architect, Raigmore Hospital, Inverness.

Oct. 20.—Burntisland T.C. Electrical work in 32 houses at Grange site. Surveyors, C. R. Douglas and Co., 15 East Port, Dunfermline.

Oct. 21.—Auchterarder T.C. Electrical installation at 16 houses. R. M. Young, Town Clerk. Deposit £1.

Oct. 21.—Lancashire. Renewal of electrical installation at Regent St. secondary modern school and Bullough Moor junior and infants school, Heywood. County Architect, County Offices, Preston.

Oct. 21.—Bromsgrove R.D.C. Pumping plant at Belbroughton comprising 2 centrifugal pumps with motors, switchgear, valves, wiring, etc. Capacity 65 gall. per min. Fiddian and Deeley, 13 Church St., Stourbridge. Deposit £3 3s.

Oct. 21.—Manchester. Three compressors, mobile trailer with diesel or petrol engine drive; two 2/3 ton mobile cranes, diesel or diesel/electric driven. Chairman of Waterworks Committee, Town Hall, Manchester 2.

Oct. 21.—Saltcoats T.C. Electrical installation in 50 houses on New England site. Robert Rennie, architect, 33 Vernon St., Saltcoats.

Oct. 23.—Shrewsbury T.C. Supply and erection of 56 precast reinforced columns 25 ft. high with wiring and fixing of lanterns with H.P.M.V. lamps and gear for Shrewsbury-Hereford (A49) Rd. F. R. Dinnis, Borough Surveyor, The Guildhall, Shrewsbury. Deposit £2 2s.

Oct. 26.—Birmingham. Electrical alterations to Field House, Clent. Herbert J. Manzoni, City Engineer and Surveyor, Civic Centre, Birmingham 1. Deposit £2 2s.

Oct. 26.—Stirling. Electrical work in erection of 18 houses on Bannockburn site, 68 at Larbett and Stenhousemuir sites, and 18 at Airth site. A. J. Smith, County Architect, Education Offices, Spittal St., Stirling. Deposit £2 2s.

Oct. 27.—Inverness T.C. Electrical work for pavilion at Ness Islands. J. Blackburn, burgh architect, 11 High St.

Oct. 27.—Sunderland T.C. Repairs and extensions to electrical installation at Burdon Hall. Borough Architect, Grange House, Stockton Rd. Deposit £2 2s.

Oct. 27.—Derbyshire C.C. Street lighting equipment on Derby to Nottingham Rd. and roundabout at Spondon. City Surveyor, County Offices, St. Mary's Gate, Derby. Deposit £2 2s. (See Oct. 12 issue.)

Oct. 27.—Stirling C.C. Supply and erection of 22 concrete lamp columns including 145 yd. of underground cable for street lighting on Langton housing scheme. Also erection of 63 steel lamp columns, brackets, lanterns, sodium vapour lamps, switches and laying of 580 yd. of underground cable on A9 road, in Laurieston and Polmont. Separate contracts. Thos. F. McGlashan, County District Sanitary Inspector, County Offices, Falkirk. (See Oct. 5 issue.)

Oct. 27.—Warwick T.C. 109 concrete lighting columns, 110 horizontal burning m. vapour lamps and ancillary gear and removal of 60 existing columns on Stratford to Warwick and Emscote Roads. R. Wormwell, Borough Engineer and Surveyor, 20 The Butts, Warwick.

Oct. 28.—Bromsgrove U.D.C. Electrical installation in 130 houses on Charford estate. Engineer and Surveyor, Council House, Bromsgrove.

Oct. 28.—Sutherland T.C. Electrical work to a block of 2 houses and 2 garages. E. W. Brannen, Carnegie Buildings, Dornoch.

Oct. 30.—Bradford. Electrical installation, lighting and heating at Allerton school. City Architect, Town Hall.

Oct. 30.—Manchester. Electrical installation at Newall Green infants' school, Wythenshawe. City Architect, Town Hall. Deposit £1 1s. (See Sept. 28 issue).

Oct. 31.—Pontefract T.C. Installation of electricity in 98 houses on Westbourne estate, 170 at Willow Park, 188 at Baghill, 107 at Kings Mead, 42 at Love Lane, 89 at Eastbourne, 140 at Monkhill and Micklegate Square, and 48 at Halfpenny Lane. Borough Engineer, Municipal Offices.

Nov. 6.—Heston and Isleworth. Removal of existing columns and lanterns and supply of 72 street columns and 76 lanterns with 400 W mercury vapour discharge lamps along Bath Rd., Cranford. Borough engineer and surveyor, 88 Lampton Rd., Hounslow. Deposit £2 2s. (Advertised in this issue.)

Nov. 6.—West Riding. Electrical installation in Goole Boothferry Rd. primary school. County Architect, Bishopgarth, Westfield Rd., Wakefield. Deposit £1 1s.

Nov. 7.—Gillingham T.C. Electrical installation in Featherby Rd. infants school. Borough engineer and surveyor, Municipal Bldgs., Gillingham. Deposit £3 3s.

Nov. 24.—Belfast. Fire-fighting equipment for protection of 33 kV switchgear for Mountpottinger substation, Thorndyke St. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle-on-Tyne 1. Deposit £5 5s. (Advertised in this issue.)

Nov. 28.—Bradford T.C. Electrical installation in St. Bede's Grammar School, Heaton. Applications to J. H. Langtry-Langton, architect and surveyor, 8, Oak Mount, Manningham, Bradford, by Oct. 21. Deposit £2 2s.

Dec. 2.—Newcastle-on-Tyne. Electric lighting and power installation at Ravenswood Rd. county primary school. Apply by Nov. 4, giving evidence of contracts exceeding £5,000 in last five years. R. W. Gregory and Partners, Education Dept's. Consulting Engineer, Northumberland Rd. Deposit £5 5s. (Advertised in this issue).

Dec. 13.—Aireborough U.D.C. Reinforced columns and brackets, also supply of lanterns and auxiliary gear for installation of fluorescent street lighting along 2½ miles of Leeds Rd. Engineer and Surveyor to Council, Council Offices, Rawdon, nr. Leeds. Deposit £2 2s. (See Oct. 12 issue.)

No date stated.—Aberdeen. Electrical engineer work for restoration of Middlefield primary school. J. A. O. Allan, Ross and Allan, architects, 10 Bon-Accord Sq., Aberdeen.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

Oct. 25.—Cape Town. Cables and jointing material for a working pressure of 12 kV, neutral point must not be earthed. Cables for pressure of 660 V. City Electrical Engineer, 3rd Floor, Electricity House, Strand St., Cape Town.

Oct. 29.—Persia. 1,000 insulators, 160 yd co-axial cable, 1,800 yd telephone cable, 30 terminal strips, three H.F./D.F. receiving stations complete, one frequency measuring standard, 14 teleprinters, 10,000 yd 1,500 V insulation cable, 10 transmitters 200-400 kc/s., for Economy and Purchases Dept., Seven Year Plan Organisation, Rue Amirieh, Shahpur Ave., Tehran. Deposit 5% total cost. B.o.T. (Ref. CRE (IB) 67143/50).*

Oct. 30.—Canada. One synchronous condenser rated at 2,500 kVA and associated voltage regulators and switching equipment for Manitoba Power Commission. W. D. Fallis, General Manager, 602 Canada Building, Winnipeg. B.o.T. (Ref. CRE (IB) 66205/50).*

Oct. 30.—India. 20,000 Suspension disc insulators. Trade Commissioner for Mysore, 9 Clifford St., London W.1.

Oct. 31.—Johannesburg. Two 35/40 kW and one 20/30 kW generating sets. Also distribution and street lighting network and transmission line. Approx. 265 poles, 60 street lights and 125 house consumers' service connections to be installed. Town Clerk, Outjo. Deposit £2 2s.

Oct. 31.—Wellington (N.Z.). 72 potentiometers (wire wound, 4 W, 200 ohms, with operating shaft insulated from winding), for Director General (Stores Division), G.P.O., Wellington C.I. Contract No. P. and T. 150/3720.

Nov. 6.—S. Rhodesia. 15 sets 66 kV automatic opening disconnecting switches and 12 sets 66 kV disconnecting switches (enquiry 1255/1950) for Electricity Supply Commission, P.O. Box 377, Salisbury. B.o.T. (Ref. CRE (IB) 66493/50).*

Nov. 13.—Johannesburg. One 300 kVA and one 100 kVA transformer suitable for 11 kV/400/230 V. Town Clerk, Hermanus. Deposit 10s. 6d.

Nov. 14.—Pakistan. Supply of cable assault. Commercial Secretary, Supply and Stores Dept., 40 Lowndes Sq., London S.W.1. Fee of 5s. (Ref. SD 7224). (See Oct. 12 issue.)

Nov. 15.—New York. United Nations at Lake Success are calling for tenders for 13 limiting amplifiers. B.o.T. (Ref. CRE (IB) 66850/50)*. Also for four studio console units. B.o.T. (Ref. CRE (IB) 6652/50).

Nov. 16.—Wellington (N.Z.) 225 tons of cadmium-copper wire for Director General (Stores Division), G.P.O., Wellington C.I. Contract No. P. and T. 150/3710.

Nov. 24.—Durban. Pedestal type, metal clad, compound filled or air insulated single busbar, switch panels of the draw-out type. Electricity Dept., Alice St., Durban.

Nov. 28.—Wellington (N.Z.). 50 kV outdoor switchgear and structure for Gisborne substation for State Hydro-Electric Department. Deposit £100.

Nov. 30.—Egypt. Electrically driven air compressor charging bottles, 3 diesel pumps, cooling tower. Chief inspecting engineer, Egyptian Government, 41 Tothill Street, S.W.1. (Ref. 74/GPR 50/42).

Dec. 2.—Egypt. 167 km. underground cable for Cairo Electricity and Gas Administration, 53 Fouad El Awal St., Cairo. Documents available at 41 Tothill St., London S.W.1. Ref. No. 30/Elec. and Gas 3-2-50-75. Deposit £5 2s. 6d. per set. (Advertised in this issue.)

Dec. 6.—Queensland. 200 Distribution transformers between 5 and 250 kVA; one 66/11 kV, 1,000 kVA, four 66/11 kV, 500 kVA, and two 33/11 kV,

Your Queries — Answered

"Capothene" sheathed cables, makers of? P.G.—Cables and Plastics Ltd., 401a York Rd. Leeds 9. (18869)

"Shenphone" transformers, makers of? B.F. Frooms and Co. Ltd., 226 High Rd. Leyton, E.10. (18873)

"Prefect" washing machine, makers of? A.D.—Clegg and Coape, Molesworth St., Rochdale. (18876)

"Carrene" refrigeration chemicals, suppliers of? F.C.—Carrier Eng. Co. Ltd., 24 Buckingham Gate, London S.W.1. (18878)

"Easy" washing machines, agents for? C.M.—Metalcraft Mfg Co. (Canada) Ltd., 72 Newman St., London W.1. (18882)

"Domas" immersion heater, makers of? N.E.—Domas Products and Accessories Ltd., 77 Allcock St., Birmingham 9. (18887)

"Thermat" pads, makers of? W.W.—Thermat Ltd., 132 Arkwright St. Nottingham. (18892)

"Casco" dry shaver, makers of? W.R.W.—These were made by the Casco Products Corpn, Bridgeport, Conn. We understand that L. G. Hawkins and Co. Ltd., 30/35 Drury Lane, W.C.2, can supply spare blades (18896).

The above are selected from questions we have answered this week. If you have a query, send it to us.

ANSWER WANTED

"Filgrate" imitation coal fire units, makers of? M.A. (18907)

1,000 kVA "on load" transformers; two 66/33 kV and one 6·6/22 kV, both 1,000 kVA, "off load" transformers. State Electricity Commission. B.o.T. (Ref. CRE (IB) 65507/50).*

Dec. 9.—Johannesburg. Steam-raising plant, generating plant, power station switchgear and cabling, for municipality of George. Documents from Preston House, Simmonds St. South, Johannesburg. Deposit £3 3s.

Dec. 21.—Brisbane. 44,000 V automatic outdoor type switchgear. Ten 400 A oil circuit-breakers of 350 MVA and seven ditto for control of "on load" tap changing transformers. For City Electric Light Co., Ltd. B.o.T. (Ref. CRE (IB) 66325/50).*

Dec. 21.—Brisbane. 30,000 kW turbo-alternator and accessories consisting of turbine, alternator, condenser, regenerative feed-heating equipment for Bulimba "B" power station. City Electric Light Co. Ltd., Boundary St., Brisbane. B.o.T. (Ref. CRE (IB) 63728/50).*

Jan. 17.—Uruguay. Fuel supply installations, turbo-alternators, equilibrating machine, pumps, valves and electric equipment for circulating water, filtering equipment, h.t. cells, control board, transformer substation, accumulators for thermo-electric power station. Usinas Electricas y Telefonos del Estado. B.o.T. (Ref. CRE (IB) 60735/50).*

Jan. 24.—New South Wales. Supply and erection of 1,500 V overhead conductor equipment for electrification of railway between Parramatta and Lithgow, comprising 20 miles of quadruple and 64 miles of double track. Agent-General for N.S.W., Engr's branch, 56 Strand, W.C.2. Deposit 7s. 6d. (Advertised in this issue.)

Jan. 30. — Wellington (N.Z.). 11 kV switchgear, 250 MVA, 11,000 V, comprising 9 panels of switchgear, one switch-handling truck, one outdoor current transformer, for Kinleith substation. B.o.T. (Ref. CRE (IB) 65595/50).*

Feb. 13.—Wellington (N.Z.). State Hydro-electric Dept. wants six 220 kV 2,500 MVA and five 110 kV 2,500 MVA, circuit-breakers and accessories for Roxburgh power station. Documents available at N.Z. Govt. Offices, John Adam St., W.C.2.

Feb. 20.—Wellington (N.Z.) Nine 66 kV 1,500 MVA circuit-breakers and accessories and four 220 kV 2,500 MVA ditto for Islington substation. State Hydro-Electric Dept. Documents available at N.Z. Government Offices, John Adam St., W.C.2.

Feb. 27.—Wellington (N.Z.) State Hydro-Electric Dept. wants four 220 kV 2,500 MVA circuit-breakers and accessories for Whakamaru power station. Documents available at N.Z. Govt. Offices, John Adam St., London W.C.2.

Mar. 13.—Wellington (N.Z.). Two auxiliary generating sets each comprising a 750 b.h.p. water-driven turbine and a 625 kVA generator together with accessories, for Roxburgh power station.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday evening)

	£ s. d.	New York price
COPPER, electrolytic	202 0 0	£196 0 0
Delivered in 2nd and 3rd month after order	215 10 0	—
Delivered in 4th, 5th and 6th month after order	217 0 0	—
LEAD, good soft pig (foreign)	128 0 0	128 0 0
,, ,, ,, "English" quality	129 10 0	—
Delivered in 2nd and 3rd month after order, plus	7 0 0	—
TIN (99·99·75%) (Cash)	880-883	—
,, (3 months)	858-860	—
ALUMINIUM, commercial purity (del.)	120 0 0	—
ZINC	151 0 0	140 0 0
ARMOURING:		
Galv. Steel Wire (0.104 in.)	45 10 0	—
Mild Steel Tape (0.04 in.)	26 0 0	—

CONTRACTS PLACED

Coventry T.C. Electrical work at Wyken Croft primary school. Electrical Installations, Ltd. £3,053; electrical installation at Howes Lane primary school. Thompson Electrical Co. £1,730.

Dudley T.C. Installation of electricity in 50 houses at Woodside. Conroy and Owen, Ltd. £1,120.

Hull T.C. Electrical installation to 106 houses on Bilton Grange estate. C. F. Proctor. £3,492; electrical installation to 34 houses at Dunston Rd., Howdenshire Electrical Contractors, Ltd., £1,123; installation of electric lighting at Charterhouse Lane School and Sutton School for Deaf. Booker and Tarran, £1,847.

Luton T.C. Electrical installation in 422 houses at Farley Hill estate. Knights (Hendon) Ltd. £10,761.

Retford T.C. Installation of street lighting. The G.E.C., £6,146.

Tyneside. Building and installation of turbo-alternators at power stations to be erected at Blaydon and Newburn. C. A. Parsons and Co., Ltd. £3,000,000.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Elmech Ltd. Meetings of members and creditors to be held at 47 Mosley St., Manchester 2, at 2.45 and 3 p.m. respectively on November 10, to receive liquidator's report.

Signal Developments Ltd. Resolution for voluntary winding-up at a meeting on Oct. 3. Alexander Bleazard (Bowman, Grimshaw and Co.) of 26 Birley St., Blackpool has been appointed liquidator.

E. J. Pike (Radio Accoustics) Ltd. Resolution for voluntary winding-up passed at meeting on Sept. 21. B. Walker, of Lovewell Blake and Co., and E. W. Freeman of Barnes, Freeman and Co., of 63 and 22 London Rd. North, Lowestoft appointed joint liquidators.

BANKRUPTCY ACTS

First Meetings

London. John Bernard Wicks, radio and television engineer, trading at 33 Holland St., Kensington. First meeting at Bankruptcy Buildings, Carey St., W.C.2, on Oct. 20, at 12 noon. Public examination at same address at 11 a.m. on Nov. 21.

Ashton-under-Lyne. Stanley Frank Bent, trading as S. F. Bent and Sons, electrical contractors, at 362 Ashton New Rd., Bradford, Manchester. First meeting held on Oct. 17. Public examination at Town Hall, Ashton-under-Lyne on Nov. 27, at 2 p.m.

Brighton. M. R. Balsden, radio engineer, of 43 Brunswick St. West, Hove. First meeting at 11 a.m. on Oct. 18 at Official Receiver's Office, 8 Old Steine, Brighton, and public examination at 10.30 a.m. on Nov. 24 at Court House, Church St., Brighton.

BUSINESS PROSPECTS

HOME

Aldridge (Staffs) U.D.C. Erection and completion of 72 houses at Walton Rd. Thos. H. Partridge, Clerk to the Council, Council House, Aldridge.

Barnsley T.C. Erection of 40 flats on New Lodge Farm estate. Borough Engineer, Town Hall.

Belfast R.D.C. Proposed to erect 24 cottages at Hannahstown and 26 at Upper Ballysillan.

Cardiff. Erection of grammar school in Colchester Ave. City Surveyor, City Hall, Cardiff.

Coventry. Erection of special school on Whitley Abbey estate for E.C. Applications to W. L. Chinn, Director of Education, Council House.

Darlington. Factory covering 67,000 sq. ft. is to be built on Aycliffe estate for manufacture of synthetic resin.

Derwent (Yorks) R.D.C. Erection of 10 houses at Cliffe and four each at Wheldrake and South Duffield. Architect, E. Vyvyan Hunter, 9 Minster Yd., York.

Downpatrick (Co. Down) R.D.C. Erection of 12 houses at Marshallstown and 12 at Ballytrim. Ogilby and M'Cutcheon, quantity surveyors, Lombard St., Belfast.

Dumbarton T.C. recommended to approve installation of electric lighting in 438 houses at Silverton at estimated cost of £5,143.

Dover (Kent). R.D.C. proposes to erect 20 houses at Temple Ewell, 10 each at Alkham and Sheperdswell, 16 at St. Margarets, and 8 at West Hougham.

Dungarvan (Co. Waterford) U.D.C. Construction of 66 houses at Gallowshill. Town Clerk, Town Hall.

Glamorgan. Erection of county primary school at Colcot, Barry, for C.C. County Architect, L. R. Gower, Glamorgan County Hall, Cardiff.

Gwyrfai (Caernarvon) R.D.C. Erection of 20 houses at Talysarn. D. H. Roberts, Architect, Cwellyn, Caernarvon.

Hendon T.C. Erection of 80 flats at Edgware Rd. Borough Engineer and Surveyor, Town Hall, Hendon, N.W.4.

Kettering. E.C. to invite tenders for erection of the Henry Gotch secondary modern school.

Lancashire C.C. Erection of nursery schools at Bacup Thorn, Leigh Mather Lane. G. Noel Hill, County Architect, County Offices, Preston.

Lewes T.C. Erection of 26 houses on Church Lane estate. Borough Engineer and Surveyor, Council Offices, Fisher St.

Liverpool. Alterations and additions to X-ray Dept. at Alder Hey Hospital at West Derby for Liverpool Regional Board. Regional Architect, Alder Hey Hospital, West Derby, Liverpool 12.

Maesteg (Glam.) U.D.C. Erection of 64 houses at Turberville site. Evan Davies, Engineer and Surveyor, Council Offices, Talbot St.

Meltham U.D.C. Erection of 18 houses on Sunny Heys West site. Architects are Lunn and Lunn, Milnsbridge, Huddersfield.

North-Eastern R.D.C. Construction of 20 houses at Heighington. Council's Surveyor, J. Chadwick, 31 Clasketgate, Lincoln.

Nottingham. Erection of the New Manvers secondary school. R. M. Finch, City Engineer and Surveyor, The Guildhall.

Ormskirk (Lancs.) U.D.C. Plans approved for erection of 28 houses on the Scott estate.

Plymouth. Erection of 20 flats in three blocks at Toronto Court, Penlee. E. G. Catchpole, City Architect, Seymour Rd.

Pontardawe R.D.C. Erection of 10 houses at Alltacham. E. D. Jones, Architect to the Council, Council Offices, Pontardawe.

Portrush (Antrim) U.D.C. Proposal approved for placing above ground a high tension line from Coleraine-Bushmills line to transformer on Parker Ave. estate.

Reading. Construction of the Mid-south secondary boys' school. Borough Architect, Town Hall.

Saltley (Durham). Installation of electricity in 13th-century church. N.E. Electricity Board will shortly complete the supplying of electricity to the village.

Sandbach (Cheshire) U.D.C. Construction of 18 houses on Crewe Rd. site. H. J. Rees, Engineer and Surveyor to the Council, Council Offices, Crewe Rd.

Shropshire. Erection of primary school at Wenlock Rd., Shrewsbury. A. G. Chant, County Architect, Column House, London Rd., Shrewsbury.

South Shields. E.C. has received sanction to borrow £1,830 for rewiring and improvements to electrical installation at Dean Rd. county secondary school.

Southwell (Notts) R.D.C. Erection of 20 bungalows at Clipstone. S. Cooper, Council's Surveyor, 8 Westgate, Southwell.

Staffordshire. Alterations to Old Hill police station and interior reconstruction of courthouse. T. H. Evans, Clerk of the County Council, County Buildings, Stafford.

Stoke-on-Trent. Recommended to invite tenders for erection of three shops and two flats at Tunstall.

Sunderland. Plans approved for erection of county primary school on Thorney Close estate at estimated cost of £110,000. Borough Architect, H. C. Bishop, Grange House, Stockton Rd., Sunderland.

Surbiton. T.C. to erect 132 houses on Chessington Court estate, 46 at Fullers Way, 18 at Lovelace estate, and 4 at Fairoak Lane.

Wallingford (Berks). R.D.C. has approved in principle erection of 150 houses at Didcot for Atomic Energy Establishment.

Wallsend T.C. Tenders are to be obtained for installation of electricity in houses lit at present by gas, and also to install additional lighting points in houses where there is electricity. Borough Engineer is G. N. Teasdale, Town Hall.

Wellingborough. Tenders to be invited shortly for erection of secondary modern school.

Westhoughton U.D.C. Erection of 40 houses and 8 bungalows on Hindley's estate. Applications to G. W. Lyth, Clerk of the Council, Town Hall.

Wokingham (Berks). E.C. to invite tenders for erection of secondary modern school on London Rd.

Worksop R.D.C. Erection of 12 bungalows at Langold. B. D. Thompson, Council's Architect, 83 Bridge St.

TRADE NOTES

Branch Office.—Dewhurst and Partner Ltd. have opened a branch office covering the North Midlands Area, at 118 Nelton Rd., West Bridgford, Nottingham. Telephone: Nottingham 88960. The office is under the control of the resident engineer and manager, Mr. A. Owen.

Changes of Address.—As from tomorrow, Oct. 20, the Middlesbrough sub-branch of the London Electric Wire Co. and Smiths Ltd. and their associates, Frederick Smith and Co. Ltd., Liverpool Electric Cable Co., and Vactite Wire Co. Ltd., will be at 148 Newport Rd. The telephone number remains, Middlesbrough 2524.

The Incorporated Sales Managers' Association has moved to new offices at 4 Holborn Place, High Holborn, E.C.1.

New Depots.—Aerialite Ltd. have opened depots at 343 Deansgate, Manchester 3 (Telephone: Bla. 3524); and at 50 Cathay, Redcliffe, Bristol (Telephone 26130).

Showroom.—Fredk. Thomas and Co. Ltd. have now opened a showroom at Everton Buildings, Stanhope St., N.W.1.

Lamp Imports.—The import of foreign-made electric lamps into the Portuguese colony of Mozambique (Portuguese East Africa) is now permitted on the scale of 40% of the total imported. The remaining 60% must be of Portuguese origin.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Christian and Crowther, Ltd., 7a The Temple, Dale St., Liverpool 2. To carry on bus. of mnfrs. of and dlrs. in refrigerators, etc. Nom. cap.: £1,000 in £1 shrs. Perm. dirs.: J. Games and W. M. Christian.

G. B. Cabinets, Ltd. To carry on bus. of mnfrs. of and dlrs. in cabinets, containers and cases particularly in relation to the radio and television industry, etc. Nom. cap.: £1,000 in £1 shrs. Perm. dirs.: A. R. Gingell, 36 Buller Rd., Barking, Essex, W. D. Brown, 13 Rhudleigh Crescent, Ilford, Essex, E. St. Patrick Iddon and D. H. Overton.

MEETINGS TO NOTE

THURSDAY, OCT. 19

I.E.E. (E. Midland Centre).—"Overhead Lines." H. W. Grimmitt. White Hart Hotel, Spalding.—7 p.m.

I.E.E. (Irish Branch).—Chairman's address. P. G. Boyd. Trinity College, Dublin.—6 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (Birmingham branch).—"Notes on Fan Application, Installation and Maintenance." J. N. Bottrill. Imperial Hotel.—6.30 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (E. Midlands branch).—Annual dinner. Grand Hotel.

FRIDAY, OCT. 20

I.E.E. (N.E. Students' Section).—Chairman's address. B. E. Western on "Teleferique." King's College, Newcastle-on-Tyne.—6.30 p.m.

JNR. INSTN. OF ENGNRS.—"Fuel and Farm Mechanisation." H. W. Arkell. 39 Victoria St., S.W.1.—6.30 p.m.

ELECT. POWER ENGNRS.' ASSOC. (Southern Meter Engnrs.' Group).—"Evolution of the House Service Meter." L. J. Matthews. Caxton Hall, Westminster.—6.30 p.m.

BIRMINGHAM ELECT. CLUB.—Ladies' evening. Dinner, dance at Grand Hotel.—7 p.m.

SATURDAY, OCT. 21

A.S.E.E. (Oxford Branch).—"Electronics in Industry." Southern Elec. Board, George St.—3 p.m.

MONDAY, OCT. 23

I.E.E. (S. Mid. Radio Group).—"Achievement of Reliability in Radio Equipment." G. W. Sutton and F. E. McGinnety. Jas. Watt Memorial Inst.—6 p.m.

I.E.E. (N.E. Centre).—"Some Notes on Electrical Installations in Large Chemical Factories." D. B. Hogg. Neville Hall, Westgate Rd., Newcastle.—6.15 p.m.

I.E.E. (London).—Discussion on "Radio Interference and the New Wireless Telegraphy Act." Savoy Place.—5.30 p.m.

I.E.E. (Mersey and N. Wales Centre).—"The Cost and Efficiency of Earthing on Low and Medium Voltage Overhead Lines Systems." L. Gosland. Town Hall, Chester.—6.30 p.m.

I.E.E. (Students' Section).—Problems night. District meeting at Gt. Western Hotel, Reading.—7 p.m.

I.E.E. (Western Utilisation Group).—Chairman's address. A. N. Irens. Elect. House, Colston Ave., Bristol.—6 p.m.

TUESDAY, OCT. 24

INSTN. OF ENGRS. AND SHIPBUILDERS IN SCOTLAND.—"Theory and Practice of Thermal Insulation." G. Laing. 39 Elmbank Cres., Glasgow.—6.30 p.m.

I.E.E. (S. Midland Centre and Radio Group).—"Achievement of Reliability in Radio Equipment." G. W. Sutton and F. E. McGinnety. Warwick Restaurant, Malvern.—7 p.m.

I.E.E. (N. Midland Centre Discussion Circle).—"Are Electrical Engineering Courses too Academic?" Lighting Service Bureau, 24 Aire St., Leeds.—6 p.m.

WEDNESDAY, OCT. 25

I.E.E. (Southern Centre).—"Review of British Underground Railway Practice." T. S. Pick and R. Dell. Tech. College, Brighton.—6.30 p.m.

INSTN. OF WORKS MANAGERS.—National luncheon meeting and annual meeting. Principal guest: Minister of Supply. Waldorf Hotel, London.—12.30 p.m.

BRIT. INSTN. OF RADIO ENGRS. (W. Midland Section).—"Loudspeaker Design." A. E. Falkus. R.G.D. Co., Ltd., Bridgnorth, Shrops.—7.30 p.m.

I.E.E. (London Supply Section).—Chairman's address. S. E. Goodall. Savoy Place.—5.30 p.m.

I.E.E. (N.W. Radio Group).—Chairman's address. A. G. S. Smith. Engineer's Club, Albert Sq., Manchester.—6.30 p.m.

I.E.E. (N. Lancs Sub-Centre).—Chairman's address. G. Pember. Harris Inst., Corporation St., Preston.—7 p.m.

THURSDAY, OCT. 26

INST. OF MECHANICS (London branch).—"Welding." F. Henry. St. Bride's Inst., E.C.4.—8 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (Liverpool branch).—Heating Quiz. Radiant House, Bolt St.—6.30 p.m.

I.E.E. (Cardiff Students' Section).—"66 kV Substations." J. D. Humphries. Bridgend Tech. College.—6.30 p.m.

A.S.E.E. (Luton branch).—"Television." G. H. Watson. George Hotel, George St.—8 p.m.

I.E.S. (Nottingham Centre).—"Rare Gas Lamps—The Gas Arc." H. W. Cummings. Gas Showrooms, Parliament St.—5.30 p.m.

I.E.S. (Bradford Group).—"Industrial Seeing." W. Imrie-Smith. Yorkshire Elect. Board, Sunbridge Rd.—7.30 p.m.

I.E.E. (Scottish Centre).—"The Application of Gas Turbine Technique to Steam Power." J. F. Field. 39 Elmbank Crescent, Glasgow.—7 p.m.

FRIDAY, OCT. 27

I.E.E. (N. Staffs Sub-Centre).—"Some Electro-Magnetic Problems." Prof. G. W. O. Howe. Crown Hotel, Stone.—7 p.m.

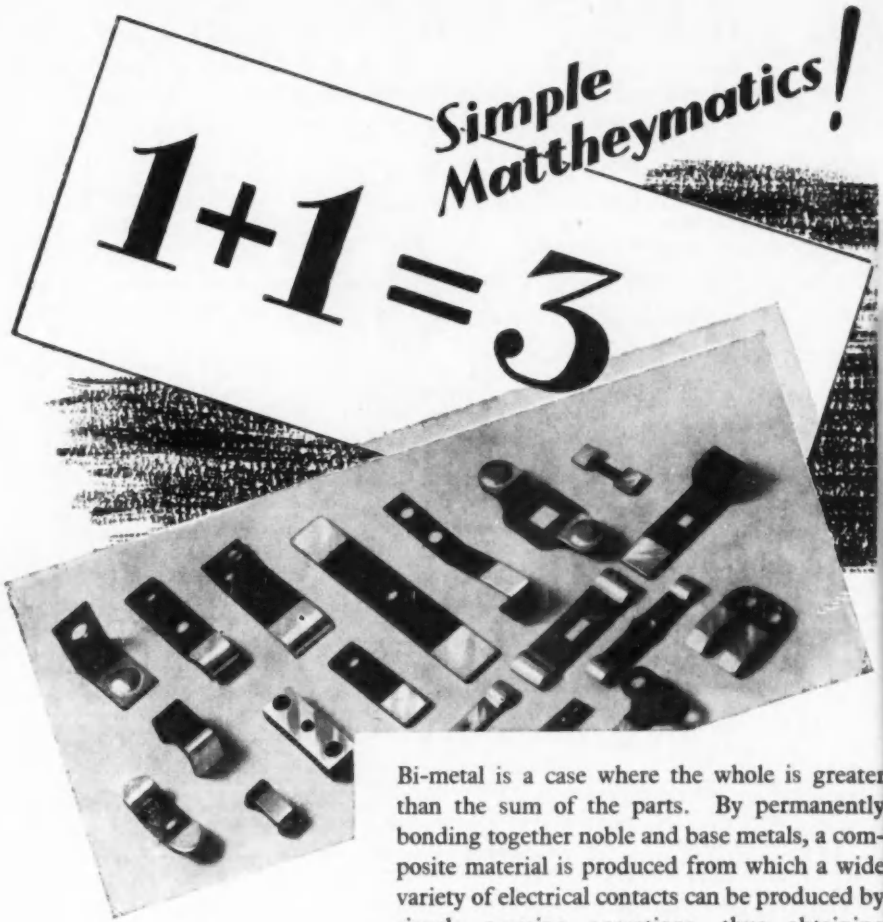
INSTN. OF HEATING AND VENTILATING ENGRS. (Manchester branch).—"Maintenance." R. Hayes. Victoria and Station Hotel.

MONDAY, OCT. 30

I.E.E. (London Radio Section).—Discussion on "Projection versus Direct-viewing Television." Savoy Place.—5.30 p.m.

I.E.E. (Western Supply Group). Chairman's address. C. Morley New. Address by chairman of Supply Section, S. E. Goodall. Elect. House, Colston Ave., Bristol.—6 p.m.

I.E.E. (Reading District).—"Wind Power." T. G. N. Haldane. Gt. Western Hotel.—7 p.m.



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GD 163

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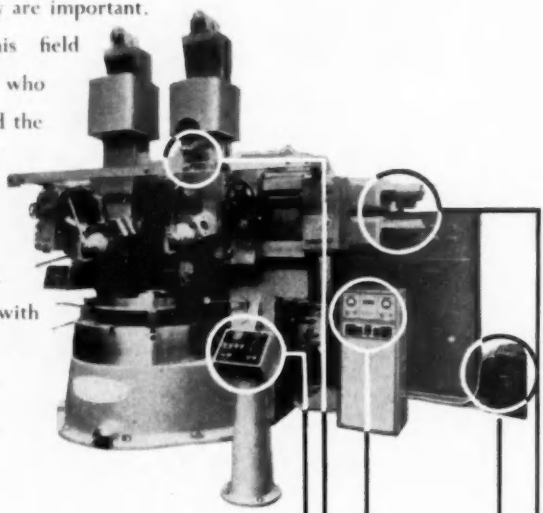
The problem of machining to irregular shapes has long engaged the attention of equipment designers and users, especially in repetition work where speed and economy, as well as accuracy are important.

A notable achievement in this field is that of Metropolitan-Vickers who have developed and manufactured the first all-British electronic two-dimensional profiling control for lathes and other machine tools. On the right is a Richards 56″ dia. vertical-wheel turning mill fitted with *the* METROVICK AUTOMATIC PROFILING EQUIPMENT.



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Operator's control station.

Template and electro-magnetic tracer head.

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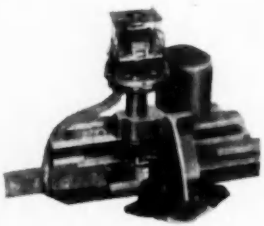
Metadyne generator set to boost amplifier output if necessary.

Vertical and horizontal motion feed motors, gear-boxes and stabilizing tacho-meter generators.



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A close up view of template and electro-magnetic tracer head with cover removed.

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G/A001

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BOROUGH OF HESTON AND ISLEWORTH

LONDON-BRISTOL TRUNK ROAD A.4
BATH ROAD, CRANFORD
STREET LIGHTING IMPROVEMENT

THE Borough Council invite tenders for installing new street lighting to Group "A" standard along a section of the Bath Road, Cranford, for a distance of approximately one mile.

The works include:
(a) the removal of existing columns and lanterns;
(b) the supply and erection of 72 steel columns;
(c) the supply and erection of 76 lanterns with 400 W Mercury Vapour Discharge Lamps.

Specifications, bills of quantities and forms of tender can be obtained from, and the drawings and conditions of contract inspected at, the office of the Borough Engineer and Surveyor, 88 Lampton Road, Hounslow, on payment of a deposit of £2 2s., which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Tenders, enclosed in a plain sealed envelope endorsed "Bath Road Street Lighting," but bearing no other indication of the name or address of the sender, must be delivered to the undersigned not later than 10 a.m. on Monday, November 6, 1950.

The Council do not bind themselves to accept the lowest or any tender.

HAROLD SWANN,
Town Clerk.

Council House, Hounslow. (G 401)

CITY AND COUNTY BOROUGH OF BELFAST

Electricity Department

TENDERS are invited for the supply, delivery and erection at Mountpottinger Sub-Station, Thorndyke Street, Belfast, of :—CO_2 Fire Fighting Equipment for the protection of 33 kV Switchgear.

Form of tender, in quadruplicate, conditions of contract, specification, and drawings may be obtained from Messrs. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle-upon-Tyne 1, on payment of a deposit of five guineas (cheques to be made payable to the Belfast Corporation Electricity Department), which deposit will be refunded provided a bona fide tender be lodged and not withdrawn. Extra copies of the contract documents may be obtained at three guineas per set which sum will not be returnable.

Each tender, in quadruplicate, in sealed envelope, marked "Tender for CO_2 Fire Fighting Equipment, Mountpottinger Sub-Station," and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, November 24, 1950.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast. (G 435)

DEPARTMENT OF RAILWAYS, NEW SOUTH WALES

PARRAMATTA-LITHGOW ELECTRIFICATION

TENDERS are invited for the design, manufacture, supply, delivery and erection of the complete 1,500 V overhead conductor equipment required for the electrification of the railway tracks between Parramatta and Lithgow, a section comprising approximately 20 miles of quadruple and 64 miles of duplicate main line track.

All supporting structures, pull-off masts and concrete foundations are to be included; alternatively, tenders excluding the supply and erection of the concrete foundations will also be considered.

Tenders will close at noon on January 24, 1951.

Copies of the Department of Railway's Specification No. 1275 may be obtained on payment of 7s. 6d. each, from the Agent-General for New South Wales, Engineer's Branch, 56 Strand, London W.C.2, to whom tenders are returnable. (G 434)

AIREBOROUGH URBAN DISTRICT COUNCIL

INSTALLATION OF FLUORESCENT STREET LIGHTING ON LEEDS ROAD BETWEEN NUNROYD, GUISELEY, AND RED BECK, RAWDON

Distance—2½ miles (approx.)

TENDERS are invited for the supply and installation of Fluorescent Street Lighting on Leeds Road between Nunroyd, Guiseley, and Red Beck, Rawdon, an approximate distance of two and a half miles. Separate tenders are invited as follows:—

1. Supply and erection of Reinforced Columns and Brackets and the fitting and wiring of Lanterns to column bases, etc.
2. Supply of Lanterns and all Auxiliary Gear.

A firm may tender for both, but the Council reserve the right to accept separate tenders from different firms.

Copies of the plan, instructions to persons tendering, specification, bills of quantities, forms of tender and schedule of rates and prices may be obtained from, and general conditions of contract seen at, the office of the Engineer and Surveyor to the Council at the address below on payment of a deposit of 2 gns., which will be returned on receipt of a bona-fide tender or the return of the documents.

Tenders, enclosed in a plain sealed envelope, endorsed "Tender for Street Lighting," must be delivered to the undersigned not later than Wednesday, December 13, 1950.

The Council does not bind itself to accept the lowest or any tender and the acceptance of a tender or tenders will be subject to the obtaining by the Council of any requisite consents.

RALPH H. HULME,
Clerk of the Council.

Council Offices,
Rawdon, near Leeds.
October 5, 1950. (G 336)

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE EDUCATION COMMITTEE

RAVENSWOOD ROAD COUNTY PRIMARY SCHOOL

TENDERS are invited from reputable electrical contractors for the electric lighting and power installation in the above school. Firms wishing to tender should apply for particulars before noon, on Saturday, November 4, enclosing (1) a deposit of Five Guineas, which will be refunded on receipt of a bona fide tender, and (2) evidence that an electrical contract exceeding £5,000 in value in a public or commercial building has been carried out satisfactorily by the Contractor during the last five years.

Plans and specifications prepared by the department's consulting engineers, Messrs. R. W. Gregory and Partners, will be issued to suitable applicants not later than November 11, and tenders are to be returned not later than first post on December 2, 1950.

The Education Committee do not bind themselves to accept the lowest or any tender.

H. V. LIGHTFOOT,
Director of Education.

City Education Office,
Northumberland Road,
Newcastle-upon-Tyne 1. (G 436)

EGYPTIAN GOVERNMENT

TENDERS are called for by the Director-General, Cairo Electricity and Gas Administration, for the supply and delivery into stores, Cairo, of 167 kilometres Underground Cables.

Tenders should be submitted to the Director-General, Cairo Electricity and Gas Administration, 53 Fouad El Awal Street, Cairo, Egypt, not later than noon on December 2, 1950.

Copies of the necessary conditions of tender, specification, etc., can be obtained on application to the Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, London S.W.1, against remittance of £5 2s. 6d. per set, which sum must be prepaid and is not returnable. Copies of these documents are also available for scrutiny at the above address. Cheques must be endorsed permitting transfer to an Egyptian Government account.

Reference No. 30 Elec. and Gas 3-2-50-75, must be quoted in all correspondence. (G 430)

APPOINTMENTS VACANT

HIS MAJESTY'S COLONIAL SERVICE

A VACANCY exists for an ASSISTANT ELECTRICAL ENGINEER, Railway Department, Gold Coast.

The post is either permanent and pensionable or on contract. If on contract the salary would be fixed between £800 and £1,450 per annum. If permanent and pensionable the salary would be in the scale £720 to £1,300 per annum, point of entry in each case depending on age, qualifications, experience and war service. For contract appointments a gratuity of £100 for each year of service is payable at the termination of service. In addition to the above a cost-of-living allowance of £114 to £165 per annum is payable, the amount depending on the salary.

Candidates must be between the ages of 25 and 50, competent engineers and be Associate Members of the Institute of Electrical Engineers or hold equivalent qualifications. They should have had an apprenticeship with a recognised firm of mechanical and or electrical engineers. A thorough knowledge of maintenance of a.c. and d.c. electrical apparatus. A knowledge of Stone's train lighting system and modern electric cranes is desirable.

Furnished quarters at rents of £60 to £150 per annum and free first-class passages each way each tour for the officer and his wife, if married, and children up to three in number and up to nine years of age, are provided. Free medical attention. Home leave on full pay at the end of each tour of eighteen months at the rate of seven days for each month of resident service. Income tax at local rates.

Intending candidates should write for further particulars and application form to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, London S.W.1, giving brief details of age, qualifications and experience, as soon as possible, quoting the reference number 27326/40. (G 409)

BRITISH ELECTRICITY AUTHORITY

London Division

BOILER HOUSE SUPERINTENDENT—HACKNEY GENERATING STATION

APPLICATIONS are invited for the above position. Applicants must have had a sound mechanical training and possess wide experience in the efficient operation and maintenance of boiler house and auxiliary plant, including coal and ash handling equipment.

Salary in accordance with the revised National Joint Board Schedule, Class "F," Grade 6, plus London allowance—£663 per annum.

ASSISTANT SHIFT CHARGE ENGINEER—West Ham Generating Station.

Applications are invited for this position from candidates with the necessary experience and qualifications.

The successful applicants will carry out the duties of Control Room Engineers or Boiler House Engineers, according to requirements, and will be directly responsible to the Shift Charge Engineer.

Salary in accordance with Revised National Joint Board Schedule, Class "G," Grade 9, plus London allowance—£589 11s. per annum.

Both appointments will be subject to the provisions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(G 397)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

PROTECTIVE GEAR ASSISTANT

APPLICATIONS are invited for this position, the duties of which will be in connection with commissioning, maintenance and testing of protective gear in the Board's generating stations and main switching stations. Candidates should have a sound knowledge of modern system of protection for high voltage plant and experience in their design and or use. They should also have had a sound technical training and preferably be corporate members of the I.E.E.

The salary and conditions of service will be in accordance with the N.J.B. Schedule, Class "AX," Grade 4, £694-£815 or higher salary according to experience. Superannuation scheme is applicable subject to medical examination.

Application form, obtainable from the Secretary, 16 Rothesay Terrace, Edinburgh 3, must be returned within 14 days from the publication of this notice. (G 452)

NORTH WESTERN ELECTRICITY BOARD

No. 6 (Lakeland) Sub-Area

APPOINTMENT OF SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEERS

APPLICATIONS are invited for the appointment of Second Assistant District Commercial Engineers in the Kendal and Whitehaven Districts of the No. 6 (Lakeland) Sub-Area.

The duties of the posts are to assist the District Consumers' Engineers generally on all matters concerning electricity service, preparation of specifications and estimates, organisation and supervision of industrial, domestic, commercial and public lighting installation work, changeover, the supervision of apparatus repairs, control of service centres, publicity, etc.

Applicants should preferably have a National Certificate in Electrical Engineering or its equivalent.

The provisional salaries for the posts will be in accordance with the N.J.B. Revised Schedule Class "D," Grade 7, i.e. £563-£568-£573 per annum. This is subject to approval by the District Joint Board and the National Joint Board.

Candidates should state the post for which they are applying and separate applications should be submitted if they desire to be considered for both positions.

Applications, stating age, qualifications and experience, present position and salary, should be received by the Sub-Area Manager, The North Western Electricity Board, No. 6 (Lakeland) Sub-Area, Castle Green, Kendal, not later than Saturday, November 4, 1950. (G 395)

NORTH WESTERN ELECTRICITY BOARD

No. 6 (Lakeland) Sub-Area

APPOINTMENT OF STATISTICAL ASSISTANT

APPLICATIONS are invited for the appointment of Statistical Assistant in the Sub-Area Consumers' Engineer's Department, Sub-Area Headquarters, Castle Green, Kendal.

The salary will be in accordance with Grade 6 of the National Joint Council (Administrative and Clerical Grades) for the Electricity Supply Industry Salary Grades, i.e., £630 by £25 to £705 per annum. The post is superannuable.

The successful candidate will be responsible to the Sub-Area Consumers' Engineer for the general organisation and supervision of all consumers' records at Sub-Area and in the districts, and for the following:

(a) The estimation of future load requirements for all classes of consumers;
(b) The preparation of monthly and annual reports on the sales and demands for electricity and electrical apparatus for industrial, domestic, commercial, and agricultural purposes.

A wide and detailed knowledge of the various tariffs in general use is essential, and a knowledge of sampling methods is desirable.

Applications, stating age, technical or other qualifications and experience, present post and salary, should be received by the Sub-Area Manager, The North Western Electricity Board, No. 6 (Lakeland) Sub-Area, Castle Green, Kendal, not later than Saturday, November 4, 1950. (G 456)

BRITISH ELECTRICITY AUTHORITY

London Division

DIVISIONAL HEADQUARTERS DRAUGHTSMEN

APPLICATIONS are invited from men with experience in one or more of the following branches in connection with the construction of power stations in the London area :—

ELECTRICAL ENGINEERING

(a) General design, assembly and layouts of h.t. and auxiliary switchgear, transformers, cables and heavy plant.
(b) Able to originate and check the associated diagrams and protective systems of the above plant both for power stations and sub-stations.

MECHANICAL ENGINEERING

General design, assembly and layouts of modern boiler and fuel handling plant, turbo-alternators and condensing plant, circulating water systems, steam, feed and auxiliary piping, foundations, etc.

The salary offered, which is provisional and subject to negotiation with the appropriate organisation, will be according to age and experience with a maximum of £600 per annum.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, and be received within fourteen days of the publication of this advertisement.

J. N. WAITE,
Divisional Controller.
(G 451)

NORTH WESTERN ELECTRICITY BOARD

No. 6 (Lakeland) Sub-Area

APPOINTMENT OF FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER

APPLICATIONS are invited for the appointment of First Assistant District Commercial Engineer in the Penrith District of No. 6 (Lakeland) Sub-Area.

The duties will be to assist generally in all activities connected with the utilisation of electricity for domestic, commercial, agricultural and industrial purposes.

Applicants should have had a wide experience in the preparation of specifications and estimates, and the supervision of all types of installations, including public lighting, the supervision of the maintenance and repair of apparatus, control of service centres, exhibitions and demonstrations, consumers' record systems, and the supervision of staff.

Technical training to Higher National Certificate standard will be an advantage.

The salary will be in accordance with the N.J.B. Revised Schedule, Class "D," Grade 5, i.e. £641-£648-£655 per annum.

Applications, stating age, qualifications and experience, present position and salary, should be received by the Sub-Area Manager, The North Western Electricity Board, No. 6 (Lakeland) Sub-Area, Castle Green, Kendal, not later than Saturday, November 4, 1950. (G 393)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following positions in the Eastern and Western Sub-Areas of the Board:

(1) ASSISTANT ENGINEER, District 443, Eastern Sub-Area, based on Ebbw Vale. Salary: Class "E," Grade 11 (£459-£467-£475) N.J.B. Schedule;
(2) ASSISTANT ENGINEER, District 462 (Newport), Eastern Sub-Area. Salary: Class "F," Grade 11 (£482-£490-£498) N.J.B. Schedule;
(3) THIRD ASSISTANT ENGINEER (Mains Construction), Western Sub-Area, Tenby. Salary: Class "G," Grade 10 (£533-£550-£561) N.J.B. Schedule.

Preference will be given to applicants who possess an engineering degree of a British University, the Higher National Certificate, or its equivalent, or have passed the Graduateship Examination of the Institution of Electrical Engineers.

Applicants are requested to state clearly for which position they are applying, and when applying for more than one position to submit copies of their application in each instance.

Applications, stating age, present position, present salary, qualifications and experience and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments), The South Wales Electricity Board, St. Mellons, nr. Cardiff, so as to reach him not later than November 4, 1950.

D. G. DODDS,
Secretary.
(G 389)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of a SENIOR DRAUGHTSMAN in the Chief Generation Engineer's (Construction) Department at Wolverhampton. The salary which is provisional and subject to negotiation with the appropriate organisation will be in the neighbourhood of £600 per annum.

Candidates should have had wide experience in the design and construction of large sheet steel structures, and should have had a sound works training in steel fabrication. The possession of an engineering degree or diploma will be considered an advantage.

Salary and conditions of service will be as agreed by the British Electricity Authority, and the appointment is superannuable.

Applications should be made on forms which may be obtained from the Divisional Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than November 4, 1950.

F. W. LAWTON,
Divisional Controller.
(G 461)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the position of SHIFT CHARGE ENGINEER at the Chadderton Generating Station, Oldham.

The post is superannuable, and the salary commences at £579 per annum, in accordance with Grade 7, Class "E," of the Revised N.J.B. Agreement.

The possession of technical qualifications will be an advantage, and experience in a modern generating station is desirable.

Applications, stating age, qualifications, and giving full details of education and experience, should be received by The Establishment Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester 20, not later than seven days after the appearance of this advertisement. (G 447)

SOUTHERN ELECTRICITY BOARD

No. 3 (Portsmouth) Sub-Area

DISTRICT ENGINEER (Portsmouth District). Salary: £827-£846-£865 per annum. N.J.B. Class "F," Grade 3. Qualifications: Wide experience in construction, operation and maintenance of distribution systems and substations at pressures up to 33kV. Experience in the control of staff and labour. Recognised technical qualifications, preferably Corporate Membership I.E.E.

AGRICULTURAL REPRESENTATIVE (Basingstoke District). Salary: £450-£510 range. Grade: Provisional. Qualifications: Sound knowledge of the application of electricity in agriculture and horticulture. Ability to prepare estimates for wiring installations and equipment, to conduct negotiations and give talks to agricultural organisations.

The successful candidates will, if eligible, be required to join the B.E.A. and Area Boards' Superannuation Scheme.

Applications should be made on a standard form, obtainable from the Sub-Area Secretary, and returned to him at Lower Drayton Lane, Cosham, Portsmouth, not later than ten days after the appearance of this advertisement.

F. W. KEMPTON,
Secretary.
(G 398)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the appointment of SHIFT CHARGE ENGINEER at Meaford Generating Station, Class "G," Grade 7, commencing salary £651 per annum.

Applicants should have had sound technical training and practical experience in the control and operation of steam generating plant and main switchgear, or mechanical and electrical experience in a manufacturer's works. Qualified marine engineers with electrical experience would be considered suitable.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms obtainable from the Divisional Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than October 28, 1950.

F. W. LAWTON,
Divisional Controller.
(G 407)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ELECTRICAL MAINTENANCE ENGINEER

APPLICATIONS are invited for the above position at the Leicester Generating Station of the East Midlands Division. Applicants should be qualified electrical engineers and have had a workshop training with wide experience of power station e.h.t. switchgear and protective gear.

Commencing salary in accordance with the National Joint Board Agreement—Grade 6, Class "G."

The appointment will be subject to superannuation under the terms and conditions of the British Electricity Authority.

Applications should be made on the appropriate form, which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, and should be returned to him not later than October 28, 1950.

W. S. BURGE,
Divisional Controller.
British Electricity House,
Barker Gate, Nottingham. (G 390)

NORTH WESTERN ELECTRICITY BOARD

No. 1 Sub-Area

APPOINTMENT OF SENIOR ASSISTANT ENGINEER (MAINS PLANNING AND CONSTRUCTION)

APPLICATIONS are invited for the appointment of Senior Assistant Engineer (Mains Planning and Construction) in the Mains Engineer's Department of No. 1 Sub-Area. Preference will be given to applicants who are Chartered Electrical Engineers experienced in mains development and construction.

Responsibilities will include planning of major low voltage cable networks; checking of district low voltage development schemes; supervision and carrying out of mains constructional work at all voltages; building construction and maintenance.

The salary will be in accordance with the National Joint Board Revised Schedule, Class "M," Grade 4, i.e. £1,150 £1,169-£1,188 per annum. The post is superannuable.

Applications, stating age, qualifications, experience, present post and salary, should be received by the Sub-Area Secretary, The North Western Electricity Board, No. 1 Sub-Area, Town Hall, Manchester, P.O. Box No. 493, not later than Saturday, October 28, 1950. (G 392)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of DEPUTY POWER STATION SUPERINTENDENT at Wolverhampton Generating Station, Class "E," Grade 3, commencing salary £775 per annum, with a plus payment of £60 per annum for control duties.

The successful applicant will be responsible to the Station Superintendent for the efficient operation and maintenance of the station, and in his absence will be required to assume full responsibility for all matters in connection therewith.

Applicants should preferably be members of one of the appropriate engineering institutions or hold at least the minimum qualification of the Higher National Certificate in engineering.

Salary and conditions of service will be in accordance with the N.J.B. Agreement and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms, which may be obtained from the Divisional Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned by October 28, 1950.

F. W. LAWTON,
Divisional Controller.
(G 408)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the positions of FIRST ASSISTANT DISTRICT ENGINEERS in Districts 461 (Pontypool) and District 443 (Ebbw Vale) of the Eastern Sub-Area of the Board.

Applicants should have experience in the construction, operation and maintenance of substations and underground and overhead high and low voltage mains in urban and rural areas.

Preference will be given to applicants who possess an Engineering Degree of a British University, the Higher National Certificate or its equivalent, or have passed the Graduateship Examination of the Institution of Electrical Engineers.

The salary for both positions will be in accordance with Class "E," Grade 4 (£722-£737-£752) of the National Joint Board Schedule for the Electricity Supply Industry.

Applications, stating age, present position, present salary, qualifications and experience, and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments Section), The South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than November 4, 1950.

D. G. DODDS,
Secretary.
(G 422)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

APPLICATIONS are invited for the position of DEPUTY POWER STATION SUPERINTENDENT, Croydon "B" Power Station.

Applicants should preferably possess the B.Sc. degree or equivalent qualification, together with experience in the operation and maintenance of modern high pressure turbine and boiler plant, e.h.t. switchgear, and in the administration of a large power station with the control of labour.

Salary will be in accordance with the N.J.B. Agreement, Class "J," Grade III, £1,066 per annum, inclusive of London allowance.

The successful applicant, if from within the industry, will be entitled to submit claims for additional travelling expenses and for removal expenses where applicable, and particulars will be available to the candidates called for interview.

Forms of application may be obtained by sending a stamped addressed foolscap envelope to the Divisional Secretary, British Electricity Authority, South Eastern Division, Lower Ham Road, Kingston-on-Thames, Surrey, and should be returned completed, together with copies of two recent testimonials, to arrive not later than October 28, 1950. (G 432)

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of BRANCH MANAGER at Perranporth in the Central Cornwall District of the Cornwall Sub-Area, at a commencing salary of £494 per annum (Class "D", Grade 9, of the National Joint Board Schedule).

The successful applicant will be responsible for the efficient management of the Branch, which covers 31 square miles, and serves approximately 2,000 consumers. The duties will include the active promotion of sales, consumer service, contracting business and the supervision of all Branch employees. He will be required to operate the l.v. distribution system, and to undertake h.v. switching operations.

Applications, giving age, present appointment and salary, and details of qualifications and experience, should be submitted to the District Manager, Central Cornwall District, South Western Electricity Board, 32 Boscawen Street, Truro, Cornwall, within 10 days. (G 462)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Transmission Department at Divisional Headquarters in North London:

GENERAL ASSISTANT ENGINEERS.

Salary range in accordance with the Revised N.J.B. Agreement, Schedule "C," Grade 8, Class "AX/CX" (£437-£604 per annum, plus London weighting).

The commencing salary will depend upon qualifications and experience.

Applicants should possess a Higher National Certificate in Electrical Engineering and preference will be given to those who have had experience in manufacture and construction of high voltage equipment.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than October 27, 1950. Envelopes should be endorsed "General Assistant Engineer (Transmission)."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (G 431)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the position of STATION SUPERINTENDENT at Cowes Generating Station, Isle of Wight.

The station has a present capacity of 11.3 MW, but is scheduled for extension, the first stage of which consists of a 12.5-MW unit programmed for completion in 1954.

Candidates should have had a wide experience in the operation, maintenance, and administration of an electricity generating station.

Preference will be given to applicants in possession of technical qualifications admitting to corporate membership of a recognised professional institution, and manufacturing works experience will be an advantage.

The terms and conditions of service will be those approved by the National Joint Board and the salary will be in accordance with Class "C," Grade 1, namely, £857, rising to £975 per annum.

Forms of application may be obtained from the undersigned, and must be completed and returned by November 3, 1950.

P. D. A. OLIVER,
Divisional Secretary.

British Electricity House,
High Street, Portsmouth.
14/10/50. (G 445)

BRITISH ELECTRICITY AUTHORITY

London Division

WEST HAM GENERATING STATION

ASSISTANT ELECTRICAL MAINTENANCE ENGINEER

APPLICATIONS are invited for the above position from candidates who have served a recognised apprenticeship with a firm of electrical engineers manufacturing h.t. switchgear, etc., and who possess technical qualifications up to Higher National Certificate standard. Some power station or erection work experience is desirable. Salary in accordance with revised N.J.B. Schedule, Class "G," Grade 9, plus London allowance = £599 11s. per annum (subject to approval of appropriate negotiating machinery).

Applications, stating age, qualifications, and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, so as to be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(G 449)

NORTH WESTERN ELECTRICITY BOARD

No. 3 Sub-Area

LINESMEN (OVERHEAD POWER)

APPLICATIONS are invited for the appointment of Linesmen (Overhead Power) in the Stalybridge District of the No. 3 Sub-Area.

The successful applicants will be required to erect and maintain overhead distribution mains and service lines.

The terms and conditions of employment will be in accordance with those laid down by the National Joint Industrial Council for the Electricity Supply Industry, the present rate of pay being 34d. per hour for a 44-hour week.

Applications, stating age, present position and experience, should be received by E. Binns, M.I.Mech.E., A.M.I.E.E., Sub-Area Manager, The North Western Electricity Board, No. 3 Sub-Area Headquarters, Union Street, Oldham, not later than Saturday, October 28, 1950. (G 391)

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

APPOINTMENT OF FIRST ASSISTANT CONSUMERS' ENGINEER

APPLICATIONS are invited for the above post in the Stafford District of the North Staffordshire Sub-Area.

Applicants should have had a sound technical training with practical experience of industrial and domestic load development, and in particular contracting work, including maintenance and consumer service. Appropriate technical qualifications will be considered an advantage.

The appointment will be in accordance with N.J.B. conditions and the salary will be Class "D," Grade 6, £594 per annum.

Applications, stating age, experience and present salary, should be forwarded within seven days to: Mr. J. G. Kellie, District Manager, Midlands Electricity Board, Gaolgate, Stafford, Staffordshire.

A. STEPHENS,
Secretary.

September 29, 1950. (G 423)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

UNIT OPERATORS

APPLICATIONS are invited for the positions of 4 SHIFT UNIT OPERATORS at Portobello Power Station, Edinburgh. The men selected will work on shift under the immediate supervision of the Junior Shift Engineer. Their duties will involve the control and log-keeping of 60 MW boiler/turbine units and auxiliaries. The boilers will be fired by pulverised fuel.

Applicants should have turbine and boiler operating experience with some technical qualifications. Certificated marine engineers would be suitable.

Rates of pay and conditions of employment will be in accordance with the Agreement of the National Joint Industrial Council for the Electricity Supply Industry. The rate of pay will be 3s. per hour, plus 2d. per hour shift rate.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, High Street, Portobello, Midlothian. (G 421)

MUNICIPALITY OF SINGAPORE

ELECTRICITY DEPARTMENT

APPLICATIONS are invited for appointment of COMMERCIAL ENGINEER on permanent staff. Qualifications: A.M.I.E.E. or equivalent, with wide experience load survey and development, tariffs, showroom organisation, salesmanship, publicity, and services to domestic and industrial consumers.

Basic salary scale, $440 to $870 per month, starting point according to qualifications and experience. Graduated scale of allowances, e.g., present allowances on basic salary of $560 p.m. amount to: Expatriation $110 p.m., plus cost of living, $192 p.m. for single man or $246 p.m. for married man or $318 p.m. for married man with family. One Malayan dollar equals 2s. 4d.; thus a married man with family on basic salary of $560 p.m. would draw equivalent of £1,383 per annum.

Quarters, with heavy furniture provided at rental of 8 per cent. of salary or allowance in lieu. Initial engagement on three years' agreement; eight months' leave after four years' service. Free medical attention. Passages paid including family (children under 17 years). Compulsory provident fund contribution, 7½ per cent. of salary and Municipal Commissioners donate 7½ per cent., rising to 20 per cent. after 20 years' service.

Applications, in duplicate, with full personal and technical information, and copies of three testimonials, to Messrs. Peirce and Williams (Agents to the Municipal Commissioners), 1 Victoria Street, London S.W.1, before Thursday, November 9, 1950. (G 448)

MIDLANDS ELECTRICITY BOARD

Wolverhampton and District Sub-Area

DISTRICT CONSUMERS' ENGINEER, WALSALL

APPLICATIONS for the above appointment are invited from qualified engineers with a wide practical experience in the Consumers' Department of a large district.

The person appointed to the position should preferably be a Corporate Member of the Institution of Electrical Engineers and he will be responsible to the District Manager for the control and administration of commercial work in the District, including electrical contracting and negotiations with industrial consumers.

The salary will be in accordance with N.J.B. conditions and is Grade 4, Class "F," commencing at £767.

Applications, stating full details of age, qualifications, experience and present salary, should be sent to Sub-Area Manager, Wolverhampton and District Sub-Area, Midlands Electricity Board, 83 Darlington Street, Wolverhampton.

A. STEPHENS,
Secretary.
(G 433)

NORTH WESTERN ELECTRICITY BOARD

No. 3 Sub-Area

APPOINTMENT OF THIRD ASSISTANT ENGINEER (SECTION LEADER TESTING ASSISTANT (PROTECTION))

APPLICATIONS are invited for the appointment of Third Assistant Engineer (Section Leader Testing Assistant (Protection)) in the No. 3 Sub-Area, centred in the Sub-Area Testing Section at Stalybridge.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, Class "J," Grade 10, i.e., £609-£621-£633 per annum.

Applicants should have had considerable experience in the testing and maintenance of protective gear, remote control, and supervisory gear, h.v. testing and general field testing work on distribution equipment. Technical education to Higher National Certificate standard is desirable.

Applications, giving full details of age, general education, technical education, and experience, should be received by E. Binns, Esq., M.I.Mech.E., A.M.I.E.E., Sub-Area Manager, The North Western Electricity Board, No. 3 Sub-Area Headquarters, Union Street, Oldham, not later than Saturday, November 4, 1950. (G 454)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the position of ASSISTANT SHIFT CHARGE ENGINEER at Barton Generating Station, Urmston, near Manchester.

The post is superannuable, and the salary commences at £609 per annum, in accordance with Grade 9, Class "H," of the Revised N.J.B. Agreement.

The possession of technical qualifications will be an advantage and experience in a modern generating station is desirable.

Applications, stating age, qualifications, and giving full details of education, training, and experience, should be sent to The Establishment Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester 20, not later than 10 days after the appearance of this advertisement. (F 420)

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

DISTRICT APPOINTMENTS

APPLICATIONS are invited for the following positions in the North Staffs Sub-Area:—

CONGLETON DISTRICT

(1) DISTRICT ENGINEER, Class "C," Grade 3 (£710 to £724 per annum).

Applicants must have had considerable experience in all branches of distribution work, including the operation and maintenance of high- and low-voltage cables, overhead lines, sub-stations, protective gear, etc. Candidates with appropriate technical qualifications will be preferred.

(2) FIRST ASSISTANT DISTRICT ENGINEER, Class "C," Grade 5 (£604 to £628 per annum).

Applicants should have had experience in all branches of distribution work, including operation and maintenance of high- and low-voltage cables, overhead lines, sub-stations, etc. Appropriate technical qualifications will be considered an advantage.

(3) ASSISTANT ENGINEER, Class "C," Grade 11, subject to negotiation (£413 to £429 per annum).

Applicants should have had experience in distribution. Appropriate technical qualifications will be considered an advantage.

(4) DISTRICT CONSUMERS' ENGINEER, Class "C," Grade 4 (£646 to £660 per annum).

Applicants should have had sound technical training, with practical experience of industrial and domestic load development, the organisation of showroom and sales publicity, the operation of tariffs, and a knowledge of electrical contracting work.

Candidates with appropriate technical qualifications will be preferred.

LEEK DISTRICT

ASSISTANT ENGINEER, Class "E," Grade 8, subject to negotiation (£550 to £560 per annum).

Applicants should have had experience in the operation and maintenance of h.v. and l.v. cables, sub-stations, etc. Appropriate technical qualifications will be considered an advantage.

NEWCASTLE DISTRICT

ASSISTANT ENGINEER, Class "D," Grade 8, subject to negotiation (£524 to £542 per annum).

Applicants should have had experience in the operation and maintenance of h.v. and l.v. cables, sub-stations, etc. Appropriate technical qualifications will be considered an advantage.

Applications, indicating the post(s) applied for, stating age, qualifications, experience, present position and salary, should be forwarded within 14 days to Mr. H. A. P. Caddell, Manager, North Staffordshire Sub-Area, 31 Kingsway, Stoke-on-Trent.

A. STEPHENS,
Secretary.
October 10, 1950. (G 424)

NORTH WESTERN ELECTRICITY BOARD

No. 6 (Lakeland) Sub-Area

APPOINTMENT OF SENIOR SERVICE CENTRE ASSISTANT—BARROW DISTRICT

APPLICATIONS are invited for the appointment of Senior Service Centre Assistant in the Barrow District of the No. 6 (Lakeland) Sub-Area.

The salary for the post will be in accordance with Grade 2 of the National Joint Council (Administrative and Clerical Grades) for the Electricity Supply Industry, Salary Grades, i.e. £390 x £20-£450 per annum.

Applicants should be capable of taking charge of a small Service Centre and controlling staff or assisting in a larger Service Centre. Some knowledge of electricity tariffs and electrical appliances is desirable. Duties may include visiting consumers' premises. Knowledge of window dressing and display work would be an advantage.

If the E.D.A. Salesmanship Certificate is not held, the successful candidate would be expected to take a recognised course of study to obtain the Certificate.

Preference will be given to applicants who are also prepared to pursue approved courses of study in Electrical Engineering or Electrical Housecraft as may be appropriate.

Applications, stating age, education, training, present position and salary, should be received by the Sub-Area Manager, No. 6 (Lakeland) Sub-Area, The North Western Electricity Board, Castle Green, Kendal, not later than Saturday, November 4, 1950. (G 394)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments :—

Area Board Headquarters

CHIEF ENGINEER'S DEPARTMENT
SYSTEM DESIGN

SECOND ASSISTANTS (two vacancies)
(Vacancy No. 60/50) (Amended)

Applicants must have wide experience in the electricity supply industry and have ability in the preparation of technical reports and digests of data. The possession of an honours degree in electrical engineering will be an advantage. They should also be corporate members of the Institution of Electrical Engineers and experience in at least four of the following branches is necessary :—

(*a*) Design and development of distribution systems.
(*b*) Research on design and economics of electrical distribution up to 66 kV.
(*c*) Network calculations.
(*d*) Application for protective gear.
(*e*) Manufacture of electrical plant.
(*f*) Layout and construction of 66 kV and 33 kV networks and sub-stations.
(*g*) Maintenance and operation of 66 kV and 33 kV networks.
(*h*) Application and utilisation of electric power.
(*i*) Statistical treatment of data.

Salary : National Joint Board Schedule C AX2, £752-£884, rising to £966 per annum.

Applications, stating age, qualifications, branches in which they possess experience, and quoting the above vacancy number, should be forwarded to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, near Leeds, within fourteen days of the appearance of this advertisement.

No. 5 (Wakefield) Sub-Area

FIRST ASSISTANT DISTRICT ENGINEER
(Vacancy No. 62/50)
Wakefield District

Applicants should be corporate members of the Institution of Electrical Engineers or possess equivalent qualifications and must have had experience in the design, construction, operation and maintenance of h.v. and l.v. overhead and underground distribution networks, sub-station plant and ancillary apparatus. The successful candidate who will be required to reside in the Wakefield District, will be responsible to the District Engineer, and must be capable of preparing complete schemes and estimates.

Salary : National Joint Board Schedule Class " F," Grade 5, £711-£737 per annum.

THIRD ASSISTANT DISTRICT ENGINEERS
(Vacancy No. 62/50) (Two vacancies)
Barnsley District

Applicants must have had experience in a large undertaking employing e.h.v. and l.v. underground mains. Experience in fault location supervision of jointing, cable laying and the erection of overhead lines would be an advantage. Preference will be given to corporate members of the Institution of Electrical Engineers.

Salary : National Joint Board Schedule Class " F," Grade 9, £538-£560 per annum.

Applications, stating the above vacancy numbers, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, within fourteen days of the appearance of this advertisement. (G 453)

NORTH WESTERN ELECTRICITY BOARD

No. 6 (Lakeland) Sub-Area

APPOINTMENTS—SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT

APPLICATIONS are invited for the following appointments in the Sub-Area Consumers' Engineer's Department, Sub-Area Headquarters, Castle Green, Kendal:

SECOND ASSISTANT ENGINEER (DOMESTIC AND COMMERCIAL DEVELOPMENT).

Applicants must have a detailed knowledge and wide experience of the utilisation of electricity for domestic, commercial and agricultural purposes, including the following:

(a) Domestic and commercial development sales, including hire and hire purchase transactions.
(b) Supervision of service centres.
(c) Publicity and display.
(d) Organisation of exhibitions, lectures, demonstrations and film shows.
(e) The application of electricity to agriculture and horticulture.

Technical training to Higher National Certificate standard will be an advantage.

The salary will be in accordance with the N.J.B. Revised Schedule, Class "H," Grade 7, i.e. £692-£707-£722 per annum.

THIRD ASSISTANT ENGINEER (DOMESTIC AND COMMERCIAL DEVELOPMENT).

The successful applicant will be required to assist generally in the duties set out for the above position of Second Assistant Engineer.

The salary will be in accordance with the N.J.B. Revised Schedule, Class "H," Grade 10, i.e. £571-£584-£597 per annum.

SECOND ASSISTANT ENGINEER (POWER SALES).

Applicants should have knowledge of and preferably experience in:

(a) The utilisation of electricity in industry with particular reference to large industrial users, quarries and mines. A knowledge of the economics of power production, plant and public supply, together with experience in the negotiations of electricity supply agreements, and changeover from d.c. to a.c. is desirable.
(b) Application of all types of lighting to industrial premises and installation of street lighting and preparation of specifications.

Technical training to Higher National Certificate standard will be an advantage.

The salary will be in accordance with the N.J.B. Revised Schedule, Class "H," Grade 7, i.e. £692-£707-£722 per annum.

Candidates should state the post for which they are applying, and separate applications should be submitted if they desire to be considered for more than one position.

Applications, stating age, qualifications and experience, present position and salary, should be received by the Sub-Area Manager, The North Western Electricity Board, No. 6 (Lakeland) Sub-Area, Castle Green, Kendal, not later than Saturday, November 4, 1950. (G 396)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

(Ayrshire Sub-Area)

SENIOR ASSISTANT (COMMERCIAL)

APPLICATIONS are invited for the above position at Sub-Area Headquarters.

The duties will mainly be in connection with farm and rural supplies.

Applicants should be experienced in dealing with inquiries, able to give advice on the applications of electricity to farming in all its branches, and experience in exhibitions and demonstrations with lectures an advantage.

Salary and conditions in accordance with the N.J.C. Agreement, Grade 4, commencing salary £510 per annum.

Applications, stating age, present position, full details of experience, to be sent to the undersigned within 14 days of the appearance of this notice.

A. E. ROOTS,
Manager.

Greenholm Street, Kilmarnock.
October 14, 1950. (G 446)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the position of ASSISTANT SHIFT CHARGE ENGINEER at Hartshead Generating Station, Stalybridge, Cheshire.

The post is superannuable, and the salary commences at £571 per annum, in accordance with Grade 9, Class "G," of the Revised N.J.B. Agreement.

The possession of technical qualifications will be an advantage, and experience in a modern generating station is desirable.

Applications, stating age, qualifications, and giving full details of education, training, and experience, should be sent to The Establishment Officer, British Electricity Authority, Wilmslow Road, East Didsbury, Manchester 20, not later than 10 days after the appearance of this advertisement. (G 419)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF PRINCIPAL ASSISTANT TO COMMERCIAL DEVELOPMENT OFFICER

APPLICATIONS are invited for the appointment of Principal Assistant to Section Head in the Commercial Department of the Board's Headquarters, Cheetwood Road, Manchester 8, at a salary in accordance with Grade 9 of the National Joint Council Agreement, i.e., £900 to £1,020 per annum.

Applicants should have played a responsible part in conducting large-scale technical and general sales promotion schemes, including Press and publicity matters, direct mail, exhibition and showroom activities. Duties will include the operation of commercial information services and the compilation of sales staff handbooks for technical and non-technical staff. Applicants should be able correspondents and good organisers. Knowledge of tariffs, hire and hire-purchase practice, and domestic electrical appliances essential.

Applications, stating age, technical or other qualifications, training and experience, present post and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, November 4, 1950. (G 455)

LANCASHIRE COUNTY COUNCIL

APPOINTMENT of ELECTRICAL ENGINEER. Commencing salary £520, rising to £570. Applicants must have experience in the design of electrical installations for large buildings, and preference will be given to a candidate who has passed the examination of the I.E.E., etc.

Application forms, obtainable from the County Architect, County Offices, Preston, to be returned by November 1, 1950. (G 450)

A POSITION of permanency, with pension rights, on the switchgear drawing office staff of the English Electric Company at Stafford, is now available to SENIOR DRAUGHTSMEN with experience of station layout for outdoor switching stations. Experienced layout draughtsmen are asked to send particulars of their experience, quoting reference 151, to Central Personnel Services, English Electric Co. Ltd., 24-30 Gillingham Street, London S.W.1. (G 315)

AN interesting and progressive position exists for a qualified ELECTRICAL ENGINEER, in connection with the design and development of servo and electro magnetic equipment for aircraft.—Apply, giving age, details of experience and salary required to Mr. G. Orloff, Chief Designer, British Messier, Ltd., Cheltenham Road East, Gloucester. (G 233)

APPLICATIONS are invited by the English Electric Co., Ltd., for ENGINEERS having wide experience in the preparation of comprehensive and specialised schemes of machine control. Applicants must be of Higher National Certificate standard and capable of preparing schemes in detail.—Apply, quoting Reference 806, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London S.W.1. (G 334)

APPLICATIONS are invited for a number of vacancies for ELECTRICAL ENGINEERING SENIOR DRAUGHTSMEN for the installation of electrical equipment in large civil and military aircraft. Some knowledge of electronic equipment is desirable and possession of O.N.C. or H.N.C. (Elect.) preferable. The vacancies are for Cricklewood and Radlett (Herts.) drawing offices. Further vacancies exist at Cricklewood only for Junior Electrical Engineering Draughtsmen for detailing the above work. Applications from trainees wishing to take up a career in aircraft electrical installation work will be considered. The positions offer excellent opportunities for advancement to keen men. Write, stating age, and full details of experience and qualifications, to: Staff Officer, Handley Page, Ltd., Cricklewood, London N.W.2. (G 260)

APPLICATIONS are invited by the English Electric Co., Ltd., Stafford, from young ENGINEERS of graduate or Higher National Certificate standard, with experience in the preparation of control gear wiring diagrams, for training as control gear engineers on specialised schemes. Selected applicants will, where necessary, be given a short course of training and will receive full pay during this period. The positions are permanent and progressive and afford excellent opportunities.—Apply, quoting Reference 805, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London S.W.1. (G 335)

APPLICATIONS are invited from ENGINEERS with experience of the erection of heavy electrical equipment, for supervisory positions overseas. In the first instance periods of service are likely to be of three years' duration. Attractive terms and conditions of employment which will be fully explained at interview. Apply, quoting Ref. 811, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London S.W.1. (G 465)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

MEN OF ORIGINALITY, enterprise and ambition, 20 to 35 years, required for development engineering project, Birmingham district. Sound engineering background and some knowledge of electrical mechanical laboratory work essential, but academic qualifications not important. Good salary and prospects.—Box No. 1805, Electrical Times. (G 400)

APPLICATIONS are invited from men between 32 and 40 years of age for the post of ASSISTANT POWER PLANT SUPERINTENDENT at Roan Antelope Copper Mines, Luanshya, Northern Rhodesia.

The plant has an electrical generating capacity of 30 megowatts and has some 50,000 to 60,000 c.f.m. capacity in electric and turbo-driven compressors. Turbo blowers of 45,000 c.f.m. capacity are also installed.

Applicants must hold the Higher National Certificate and have had power plant or equivalent maintenance and operating experience. They should be familiar with water tube boilers, preferably pulverised coal-fired; the operation and maintenance of turbo-alternators; turbo and electric compressors; electric and steam-driven feed pumps; circulating water pumps, and other auxiliary equipment, etc. They must be able to direct operating personnel and be capable of critically examining control sheets and statistics relating to the performance of the plant.

Commencing salary from £775 per annum, depending on experience and qualifications, plus cost-of-living allowance (at present approximately £200 per annum) and bonus (at present approximately 45 per cent. of basic salary). There is also a pension and life assurance scheme.

Write: Roan Antelope Copper Mines, Ltd., Selection Trust Buildings, Mason's Avenue, London E.C.2, for official application form. (G 412)

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION Applications are invited for the appointment of an ASSISTANT to the Association's Rural Electrification Officer.

Applicants should have had training and experience in the electricity supply industry and possess a knowledge of electro-agricultural applications. Alternatively, applicants with an agricultural background possessing at the same time electrical knowledge and experience will be considered. Membership of the Institution of British Agricultural Engineers will be an advantage.

The commencing salary is £650–£750 per annum subject to experience and qualifications and in addition there is a cost-of-living bonus, which at present is approximately £60 per annum.

Applications, stating age, education, training and experience, should be submitted within 14 days of the date of appearance of this advertisement to V. W. Dale, General Manager and Secretary, British Electrical Development Association, 2 Savoy Hill, London W.C.2. (G 467)

CABLE ENGINEER required to supervise 33 kV cable laying and jointing contract abroad for approximate period of 12 months. Apply, in writing, giving details of age and experience, to: Managing Director, Scottish Cables, Ltd., Renfrew, Scotland. (G 371)

CABLE JOINTER required by large oil company for service in Middle East. Must be conversant with all types of jointing on extensive electrical system of l.t. 400 V a.c. and h.t. 66,000 V a.c. Previous experience with leading British cable company an advantage. Salary (incremental) £700. Allowances, £330 to £640, dependent on marital circumstances. Free quarters. Biennial (paid) home leave. Pensionable. No married accommodation for first two to three years.—Write, quoting No. 35, to Box 3720, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (G 440)

CABLE JOINTERS required for work on 33 kV installations.—Apply: Box No. 1803, Electrical Times. (G 399)

CONTRACTS ENGINEER for London contractor specialising in excavating, cable laying and jointing. Duties to include estimating, preparation of technical specifications and supervision of contracts. Good technical background essential.—Reply, giving full particulars, stating experience, salary required and age, Box No. 1793, Electrical Times. (G 374)

COOKE AND FERGUSON, LTD., Manchester, require a SECTION LEADER in the Designs Drawing Office. Applicants must have experience of switchgear layout and design work, and must be capable of accepting responsibility under general supervision only.—Reply, stating age, qualifications, experience, and salary required, to the Personnel Manager, Victoria Street, Openshaw, Manchester 11. (G 438)

DEMONSTRATOR, junior, required to assist at electrical exhibition. Knowledge of electrical applications essential. Salary according to N.J.C. scale, Grade 1.—Write, stating age, qualifications and experience, to Box No. 1811, Electrical Times. (G 404)

CONTROL ENGINEERS

CONTROL ENGINEERS for network operation required by Major Oil Company in Middle East for control centre covering operation of extensive overhead and underground transmission and distribution networks up to 66 kV. Applicants must possess Ordinary or Higher National Certificate in Electrical Engineering, and must be experienced in the operation of indoor and outdoor metal-clad switchgear at all voltages, transformers and associated substation equipment. Age not over 35. Attractive salary, plus generous allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements, Pension Scheme.—Write, giving personal particulars and details of qualifications and experience, quoting:

DEPARTMENT F.116 TO BOX NO. 2584 AT 191 GRESHAM HOUSE, E.C.2. (E 399p)

DESIGNER required by well-known firm of electrical engineers in the West of Scotland, with experience in the design of totally enclosed a.c. motors of from 5 to 100 h.p. Technical qualifications : Higher National Certificate, University Degree or Diploma in Electrical Engineering.—Applications, stating age, qualifications, experience and salary required, to Box No. 1813, Electrical Times. (G 410)

ELECTRICAL DESIGNER DRAUGHTSMEN required, experienced in industrial power distribution, substation layouts, and conduit lighting and power schemes. Several men required. Good working conditions; pension scheme operating.—Apply by letter, stating experience and salary required, to The Chief Draughtsman, The Lummus Co., Ltd., Imperial House, 80 Regent Street, London W.1. (G 355)

ELECTRICAL DRAUGHTSMAN required by major oil company for service in the Middle East. Must have served five years electrical engineering apprenticeship, and have had five years D.O. experience in connection with electrical layouts of large industrial plants with underground cable networks. Should possess Higher National Certificate. Graduate or associate membership of a corporate engineering body desirable but not essential. Maximum age limit 35 years. Attractive salary plus generous allowance in local currency. Free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension scheme.—Write, giving personal particulars and details of qualifications and experience, quoting Dept. F.192, to Box No. 2809, at 191 Gresham House, Old Broad Street, E.C.2. Applicants without above requirements will not be considered.(F 322)

ELECTRICAL ENGINEER, having experience in e.h.t. and l.t. distribution layouts, required for works engineer's department of large industrial concern on outskirts of Birmingham. Higher National Certificate desirable. Salary according to qualifications and experience.—Box No.1789, Electrical Times. (G 352)

ELECTRICAL ENGINEER required in London area. Able to introduce business and estimate, etc.—Write full particulars of experience and salary required to Box No. 1761, Electrical Times. (G 266)

ELECTRICAL ENGINEERS required for service in Middle East. Applicants should (a) possess Ordinary or Higher National Certificate and have had full apprenticeship with heavy electrical equipment manufacturers or with a large colliery or allied fully electrified industry, or (b) possess a degree and have had two years' technical apprenticeship with similar firm to above. In each case applicants must have had at least three years' subsequent experience on the installation and maintenance of heavy electrical equipment. Maximum age limit 35 years. Attractive salary, plus generous allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension scheme.—Write, giving particulars and details of qualifications and experience, quoting Dept. F.191, to Box No. 2916 at 191 Gresham House, E.C.2. (G 19)

ELECTRICAL ENGINEER required as chief laboratory assistant. Experience must cover design and testing of watt-hour meters, together with experience in small mechanical and electrical devices. Minimum qualification: Higher National or equivalent. S.W. London area. Write in first instance to Box No., giving full particulars and salary required.—Box No. 1801, Electrical Times. (G 398)

ESTIMATOR. Experienced Estimator for Westminster office to deal with a.c. and d.c. enquiries. State age, qualifications, experience and salary required.—Write to F.H.S., Lancashire Dynamo & Crypto Ltd., 94 Petty France, Westminster, S.W.1. (G 469)

FERRANTI, LTD. have vacancies in their meter Department for GRADUATE ENGINEERS with industrial experience in the design of electricity meters. Liberal salary, with pension benefits.—Application forms from Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference M.E. (G 327)

FOREMAN CABLE JOINTER required. Must have wide experience of 33 kV and lower voltage jointing and be capable of supervising jointers on contract work and under training.—Apply in writing, stating age, experience, and salary required, to Personnel Manager, Scottish Cables, Ltd., Renfrew, Scotland. (G 354)

JUNIOR ELECTRICAL ENGINEER required by London West End electrical contractors. Salary in accordance with qualifications and experience.—Write in first instance to Barlow and Young, Ltd., 19-21 Palace Street, London S.W.1. (G 439)

LIGHTING REPRESENTATIVE (Sales) required for fluorescent installations, London district. Must have technical knowledge of subject.—Write, giving full particulars, to Box AC.56430, Samson Clarks, 57-61 Mortimer Street, London W.1. (G 405)

ORDER CLERK REQUIRED—progressive post but must know electrical accessories and the trade.—Reply: Managing Director, E. Dawson (Lamp Factors), Ltd., 10 Grays Inn Road, W.C.1. (G 460)

OVERHEAD LINE ENGINEERS to represent Consultants on supervision of layout and construction of overhead distribution systems in North Scotland Vacancies for senior man for general organisation and for juniors, but previous experience essential in both cases.—Particulars of qualifications to: Kennedy and Donkin, 32 Alva Street, Edinburgh 2. (G 444)

REPRESENTATIVE required by London electrical wholesalers. Connection with contractors and industrial users in South London area essential—Apply, in writing, to Box No. 1791, Electrical Times. (G 373)

REPRESENTATIVE required by E.L.M.A. Lamp Manufacturer, Leicester area. To manage local depot. Established connection.—Apply, with full particulars, to Box No. 1817, Electrical Times. (F 463)

SENIOR DESIGNER, with industrial and/or traction motor control design experience, wanted by progressive manufacturer to engineer new control gear development. Salary £700 per annum.—Full particulars to Box No. 1753, Electrical Times. (G 250)

SENIOR ELECTRICAL ENGINEER required for duty in Middle East areas of large Oil Company. Honours degree and or A.M.I.E.E. qualification, with administrative experience and considerable practice in the layout, operation and maintenance of h.t. and l.t. systems from generation to end use. Desirable age limit 40. Salary (incremental) from £1,300, plus substantial allowances. Free furnished quarters messing or allowances in lieu. Biennial (paid) home leave. Married applicants must be prepared to serve singly for first 2-3 years.—Write in full, quoting No. 31, to Box 3717, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (G 427)

SENIOR METHODS AND PLANNING ENGINEER for manufacturers of electrical switches, thermostats and other controlling devices. West London factory. Only first-class applicants will be considered. State salary required.—Box No. 1777, Electrical Times. (G 309)

STRUCTURAL DESIGNERS AND DESIGNER-DRAUGHTSMEN with experience in light steel structures required for work in London office in connection with radio masts and towers.—Apply, stating age, qualifications, experience and salary required to the Staff Officer, British Insulated Callender's Construction Company, Limited, 21 Bloomsbury Street, London, W.C.1. (G 375)

HARLAND & WOLFF, Ltd.

Belfast, Northern Ireland

require an

A.C. DESIGNER

for their electrical department to take charge of the design of diesel-driven alternators from 100 to 4,000 kVA at voltages up to 6·6 kV; also to deal with other a.c. equipment. Applicants should be fully qualified and experienced for a senior post and should state in their applications full details thereof, and include age, nationality, salary expected and if a corporate member of the Institution of Electrical Engineers. (G 457p)

ELECTRICAL ENGINEER

AN ELECTRICAL ENGINEER is urgently required by major British oil company to fill vacancy on Middle Eastern Staff. The appointment is concerned with the construction of overhead power lines up to 33,000 volts over broken country. The successful candidate will, therefore, have had electrical mains training and experience of the construction of overhead H.T. power lines on steel lattice towers and of the construction of overhead and underground mains, he will also have a knowledge of cable jointing and possess Higher National Certificate. This post, the maximum age limit for which is 35 years, carries an attractive salary, plus generous allowance in local currency, free passages, kit allowance, free medical attention, good leave arrangements, and there is a Pension Scheme. Write fully, giving personal particulars and details of qualifications and experience, quoting

DEPARTMENT F.215, to BOX NO. 3949 AT 191 GRESHAM HOUSE, LONDON E.C.2.(G 470p)

SHARP CONTROL GEAR, Kings Norton, Birmingham, require REPRESENTATIVES for the Manchester and London areas. Must have knowledge of crane control gear and motor starters up to 100 h.p. Remuneration by salary, expenses and commission. Give details of experience and salary required. (G 385)

SHIFT CHARGE ENGINEER. H.N.C. standard with practical experience of charge duties in a central generating station of about 40 MW, comprising w/t boilers, turbo-alternators, h.t. switchgear, for Middle East duty with large Oil Company. Salary according to age and experience, plus allowances, £330-£640, dependent on marital circumstances. Free furnished quarters. Married applicants required to serve singly for initial tour. Pensionable post. Biennial (paid) home leave.—Write, quoting No. 34, to Box 3716, c/o Charles Barker and Sons Ltd., 31 Budge Row, London E.C.4. (G 428)

STOREKEEPER'S ASSISTANT, with old-established wholesalers. Must have full knowledge of goods handled and packing. Superannuation (Pension) Scheme. Good prospects.—Write, stating age, salary required, and full particulars to G. S. Peckham and Co., Ltd., 3-5 New Compton Street, W.C.2. (G 437)

THE General Electric Co., Ltd., has a vacancy for a TECHNICAL SALES ASSISTANT at their Head Office in London. Applicants should be between 21-25 years of age, have had a technical education not lower than Ordinary National Certificate standard and preferably have had experience of electrical installation materials.—Apply, giving particulars of age, training and experience, to the Staff Manager, Magnet House, Kingsway, London W.C.2. (G 429)

THE United Africa Co. require an ELECTRICIAN for the installation and maintenance of electrical equipment in its large sawmilling plant now under construction in the Gold Coast. The power plant is of 3,000 kW capacity with both l.t. and m.h.t. distribution to industrial plant and housing estates, where l.t. equipment only is installed.

Applicants, who should not be over 35 years of age, must have undergone good general apprentice training, followed by worthwhile practical experience, preferably including armature winding and cable jointing.

Commencing salary will be dependent on age and experience, but will not be less than £700 per annum, with furnished quarters and medical attention in Africa, family allowances and retirement benefit.

Tours of 21 months, with leave on full pay, passages provided.

Apply in writing to the United Africa Co., Ltd., Coast Staff Dept. (Timber), Unilever House, London, E.C.4. (G 468)

TRANSFORMER TEST ENGINEERS required for work on test bed of a large Midlands manufacturer. Applicants should preferably have had previous experience on medium sized power transformers, and some experience with instrument transformers would be an asset. Excellent opportunities for advancement under good working conditions for the right type of men.—Reply, giving details of experience, age, salary required, etc., to Box No. 1807, Electrical Times. (G 402)

APPOINTMENTS WANTED

BUYER, M.P.O.A., aged 28, providing positive and economic results, exp. foundry, sheet metal, vitreous enamel and light elect. eng., seeks progressive appointment.—Box No. 1781, Electrical Times. (G 318)

CHARTERED ELECTRICAL ENGINEER, A.M.I.E.E., with wide knowledge of contract work on overhead and underground transmission and distribution, desires change. Experience in management and in the co-ordination of all operations, estimating, surveying, drawing office and design, purchasing and construction. Accustomed also to establishing contacts and producing business; 15 years' experience.—Box No. 1815, Electrical Times. (G 459)

ELECTRICIAN (29), O.N.C., seeks position where he can obtain some Drawing Office and/or Estimating experience whilst studying for H.N.C. Any district considered, but prefers N.W. England.—Box No. 1799, Electrical Times. (G 380)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed.—Edgware 8631 (4 lines), Service Electric Co., Ltd., Stanmore, Middx. (D 324)

ARMATURE SERVICE CO., LTD., Haddington Street, Hove (Tel. 32996), electrical engineers and winding specialists. Distance no object. (F 739)

CAPACITY available, substantial and immediately, SHEET METAL, LIGHT PRESS WORK, FABRICATED STEEL WORK, GAS AND ELECTRIC WELDING.—C. B. McAllan (Engineers), Ltd., Cromwell House, Wood End Green Road, Hayes End, Middlesex. Hayes 3921. (G 425)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197. (F 270)

GUARANTEED, high quality Stator and Armature Re-winds, F.H.P. motors, portable tools, etc. Contract rates available.—Sarum Electric, Ltd., Brown Street, Salisbury. Tel. 4245. (G 52)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Phone: Chiswick 5105. (A 20)

PYROTENAX CABLE, names of Stockists or Agents other than makers, wanted.—West Wales Electric Ltd. Portmadoc. (G 458)

WANTED, DIESEL GENERATING SET, 27 or 30 kVA, 400/440 V, 3-phase, complete with switch panel.—North Electrical and Refrigeration Co., Ltd., 177 High Street, Northfleet, Kent. (G 301)

WANTED.—D.C. and a.c. ball-bearing MOTORS.—Full details to Britannia Manufacturing Co., Ltd., 22/26 Britannia Walk, London N.1. (A 13)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED.—Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling.—Apply, giving full details, to Midland Iron and Hardware Co., Cradley Heath. (A 5)

100 AMP Static BALANCER, 440/400 V.—Box No. 1795, Electrical Times. (G 378)

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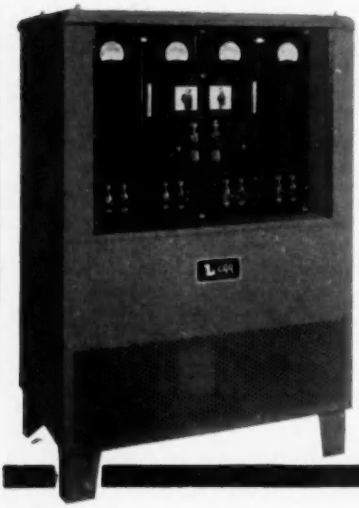

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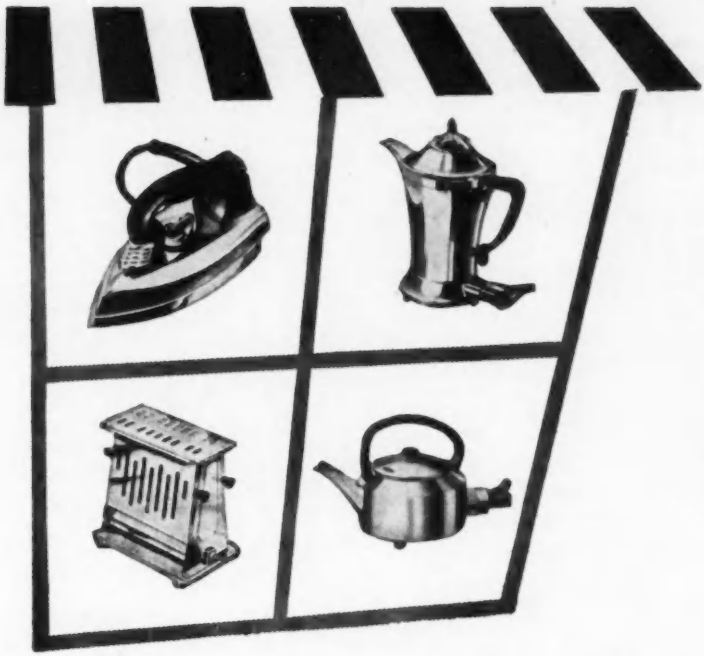

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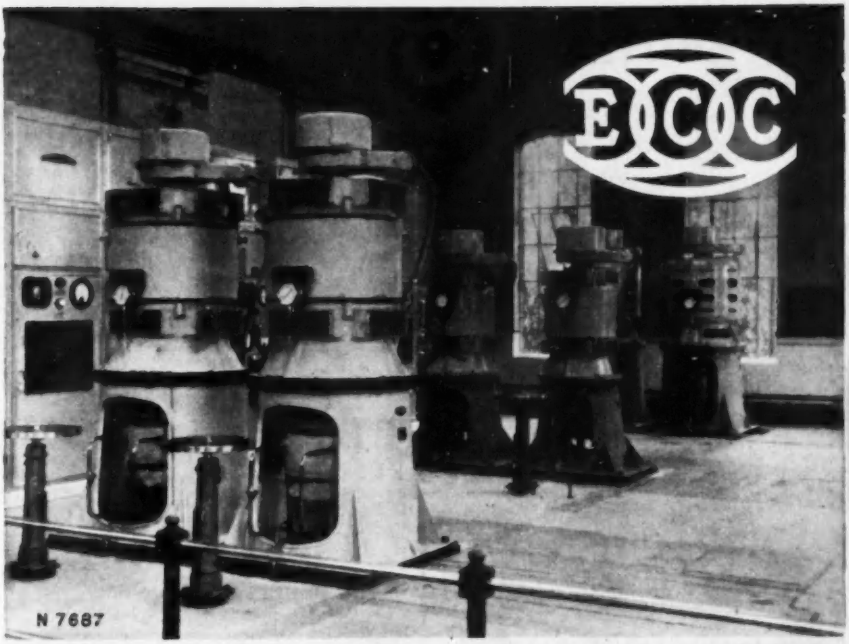

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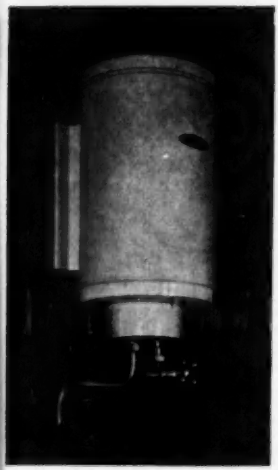

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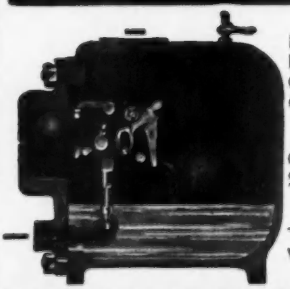

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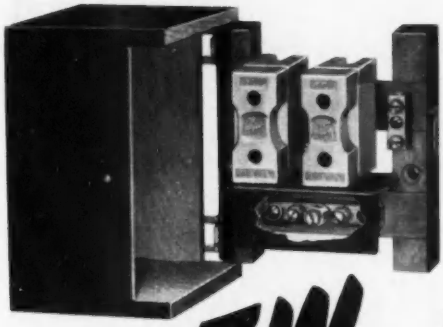

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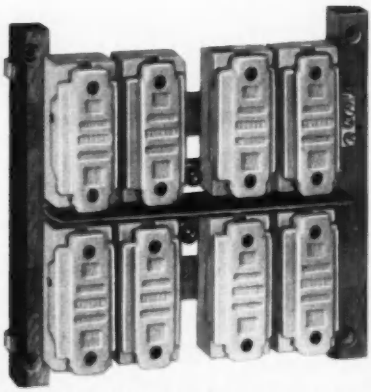

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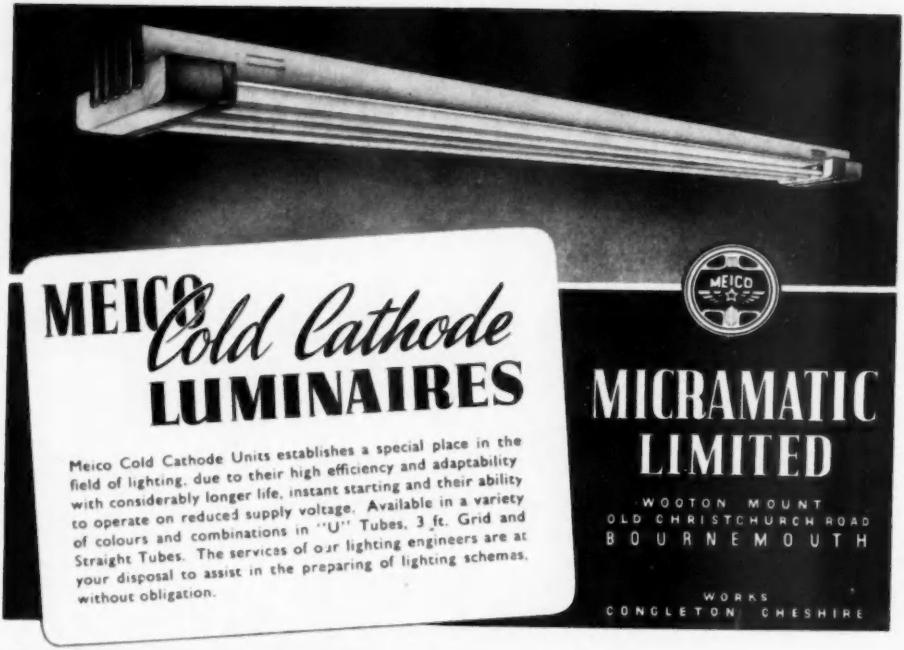
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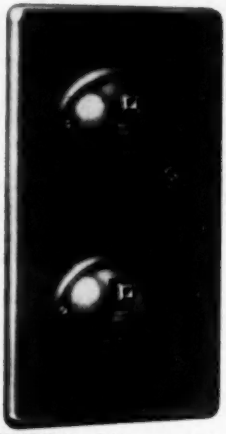

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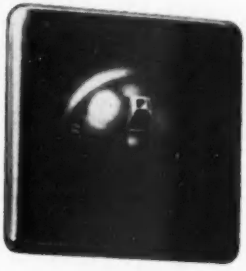

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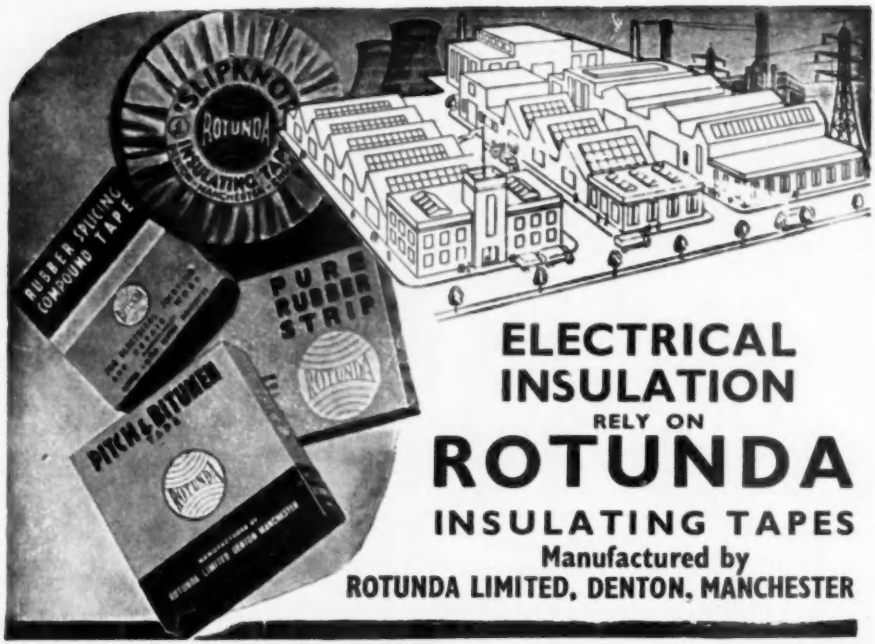

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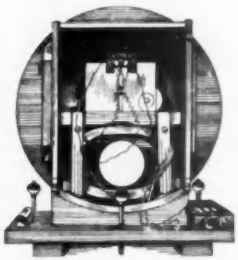

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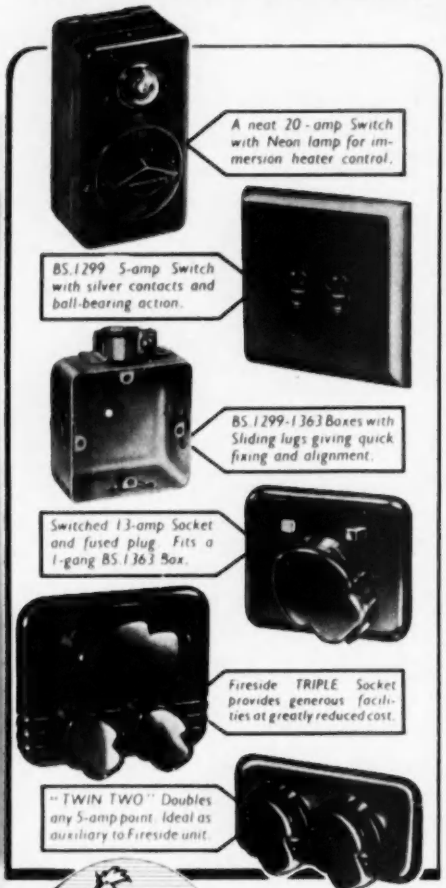
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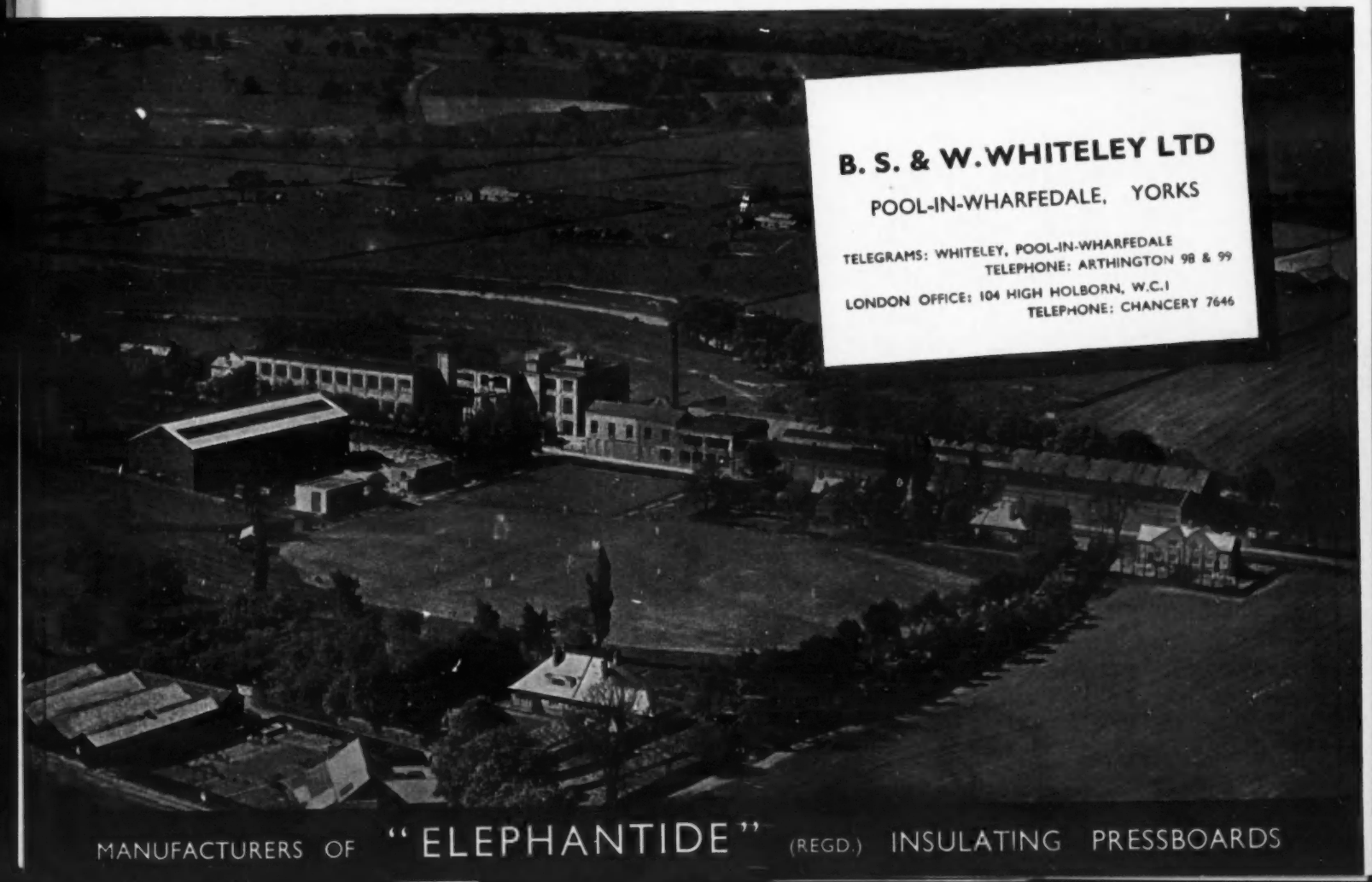
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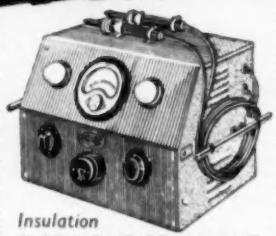

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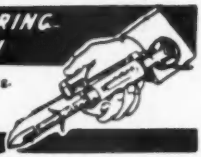

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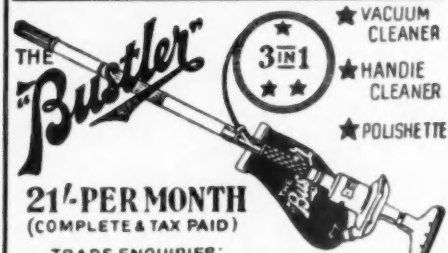

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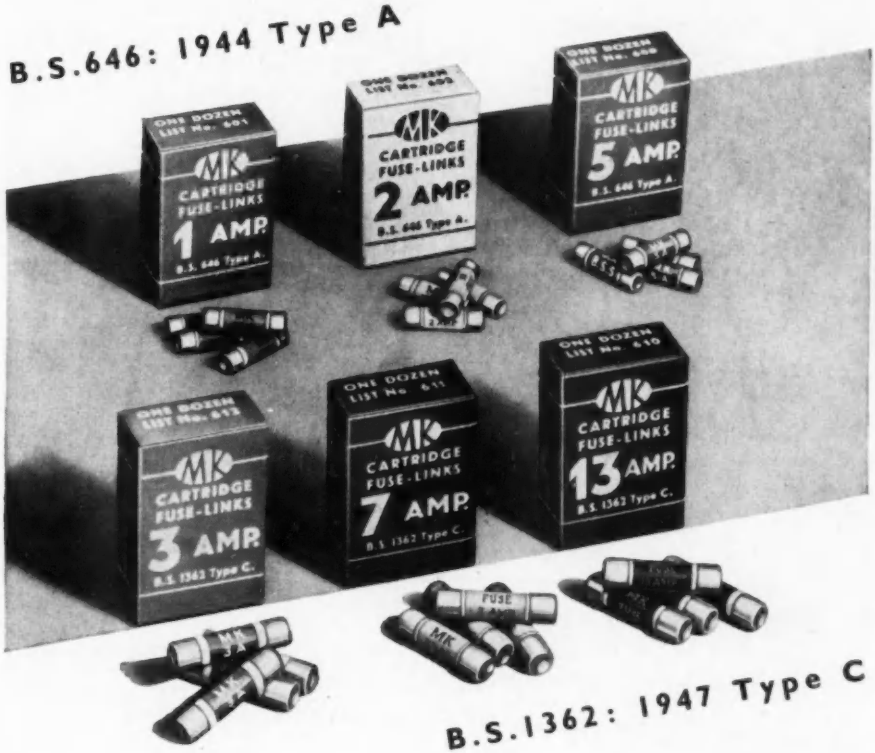
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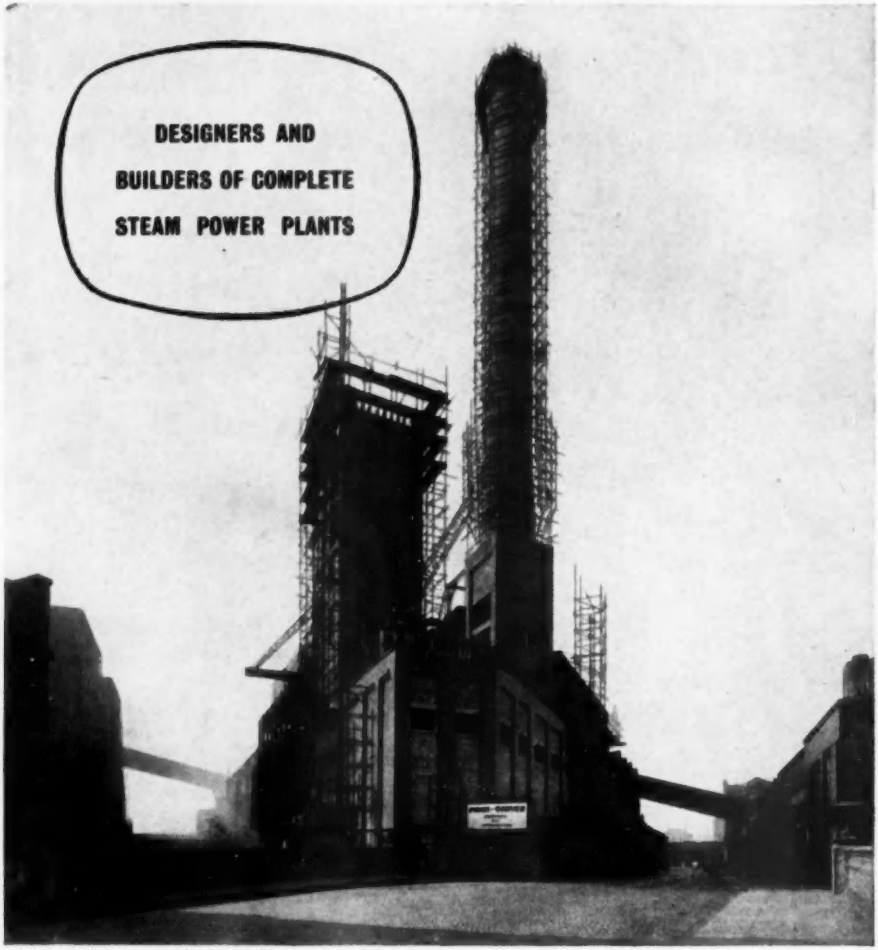

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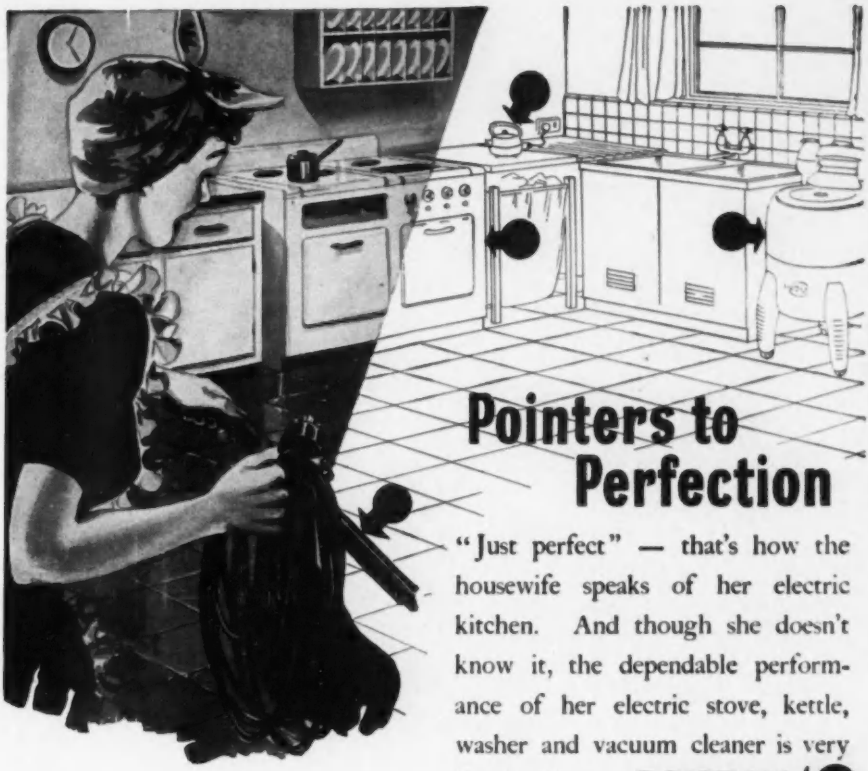

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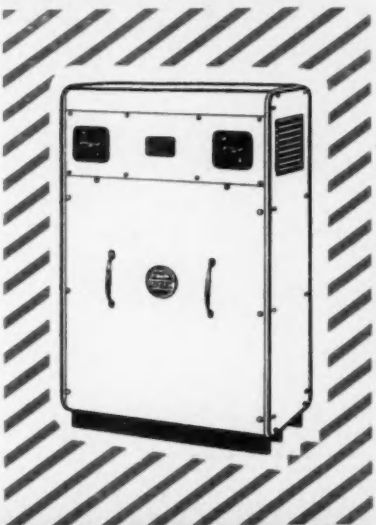

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